Another development using

B. F. Goodrich Chemical Company *raw materials*

These "O" Ring Seals made by Precision Rubber Products Corp., Dayton, Ohio. B. F. Goodrich Chemical Company supplies Hycar rubber only.

rubber "O" rings for tractors

FOR BETTER DESIGN, LONGER LIFE

REPLACING the special oil in a tractor hydraulic system can lead to trouble if any oil at hand is used—as often happens. For oil is tough on rubber—attacks the rubber sealing rings of the hydraulic system. Result—hydraulic system is less efficient and valuable time is often lost.

But now there's a new kind of "O" ring seal—a rubber "donut"—that is usable with almost *any* petroleum-based hydraulic fluid. It is made from a specially developed, extremely oil-resistant Hycar rubber compound that also has exceptionally good high and low temperature resistance. As many as 25 of these rubber "donuts" are used in some tractor hydraulic systems.

Here again Hycar demonstrates its versatility. For Hycar compounds can be made to resist oil, gas, many chemicals . . . heat and cold . . . weather, abrasion and more damaging conditions.

Hycar rubber may also be used as a synthetic resin modifier, a latex for coating or impregnating, an adhesive, and in many other applications. One of the many Hycar rubber compounds may be just what you need to improve or develop a product. Write for helpful technical bulletins or assistance. Please address Dept. HA-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Need high tensile strength? Hycar has it—plus abrasion resistance and more advantages.

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers
HARMON organic colors

The toughest low-cost tire we know

Teams Philblack* A *with* Philblack* O!

What a combination! Tire treads made with Philblack A and Philblack O laugh at cuts, cracks and abrasion!

Try this team for a tough, long-lived rubber compound for use in original treads, camelback, conveyor belts, etc. Blends of premium Philblack O and lower cost Philblack A help reduce costs while maintaining top quality in the finished product.

Tested in the laboratory by rubber torturing machines that would put the Inquisition to shame . . . tested under all driving conditions on the road . . . tire treads made with Philblack A and Philblack O turn in remarkable records every time.

The Philblacks are shipped in bags or in bulk in hopper cars designed for easy unloading.

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PHILBLACK SALES DIVISION

EVANS BUILDING · AKRON 8, OHIO

PHILBLACK EXPORT SALES DIVISION · 80 BROADWAY · NEW YORK 5, N. Y.

* A Trademark

Philblack A and Philblack O are manufactured at Borger, Texas. Warehouses in Akron, Boston, Chicago and Trenton.
West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.

best buy for shoe soles

Tests prove you get more flexibility with PLIOLITE S-6 B

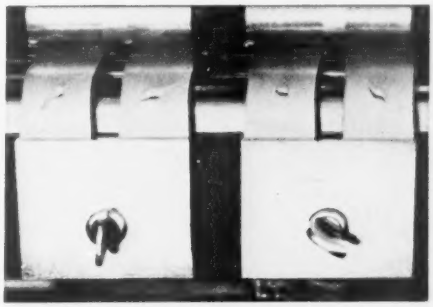
COMPARED with other resins available on the market, **Pliolite S-6 B** in shoe soles gave higher flexibility on the Ross Flex Test Machine, as shown in the inset photograph here. These pierced samples of soles made with Goodyear's new, truly easier processing resin showed markedly longer flex-life.

Shoe sole makers everywhere are turning to **Pliolite S-6 B** because of its ideal combination of qualities—lighter color, higher Shore hardness, low specific gravity, leathery "feel," and ready processability even under marginal Banbury or mill conditions.

This same combination of qualities makes this resin equally attractive to makers of flooring, molded and inflated rubber items, electrical insulation and a wide range of other products.

Why not see what **Pliolite S-6 B** offers you—by sending today for full details and samples for evaluation. Write:

Goodyear, Chemical Division, Akron 16, Ohio



COMPETITIVE RESIN **PLIOLITE S-6 B SAMPLE**

Unretouched photograph illustrates cut-growth of pierced samples of shoe soles made with **PLIOLITE S-6 B**, on right, and a competitive resin, on left. Samples are in duplicate. Compounds differ only in the type of resin used. Note greater resistance to cracking exhibited by the **PLIOLITE S-6 B** sole at equivalent flexing.

USE PROVED Products

Pliolite—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

CONTENTS

- A Short History of the St. Joseph Lead Company
- The Production of St. Joe Zinc Oxides
- General Properties of Zinc Oxide
- Zinc Oxide in Rubber Compounds
- St. Joe Rubber Grade Zinc Oxides
- Zinc Oxide in Protective Coatings
- St. Joe Paint Grade Zinc Oxides
- Zinc Oxide in the Chemical, Pharmaceutical and Other Industries
- Zinc Oxide in the Ceramic Industries
- St. Joe Ceramic Grade Zinc Oxides

As the table of contents indicates, this 55 page, illustrated book is a comprehensive manual on zinc oxides in general, and on ST. JOE Lead-Free ZINC OXIDES in particular. In preparing the book, we have included only that material which we considered to be of maximum interest and value to technologists in the consuming industries.

PLEASE WRITE FOR YOUR COPY ON YOUR COMPANY LETTERHEAD

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE, NEW YORK 17 • PRODUCERS OF LEAD-FREE ZINC OXIDES

WE COVER THE WATERFRONT

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LOTOL* Compounded Latices—Ready to Use.

KRALAC* Plastic Latices.

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SHRINK-MASTER Process for Rendering Woolens Shrink Resistant and Long Wearing.

LATEX Natural and Synthetic.

KOLOC* Cationic Resin Compositions for Cotton, Rayon and Wool.

NAUGATEX* Dispersed Chemical Compounding Ingredients for all Latices.

KRALASTIC* Flexible Plastic Latices.

DISPERSITE* Aqueous Dispersion of Rubber, Reclaimed Rubber or Resins.

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Division of United States Rubber Company

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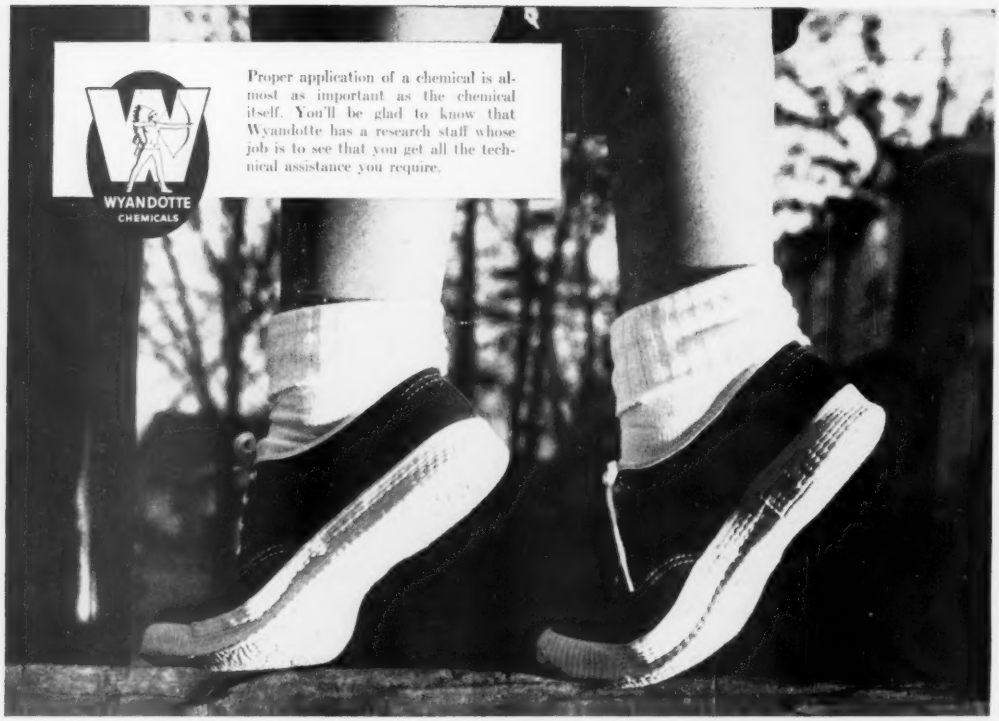
WYANDOTTE
CHEMICALS
Proper application of a chemical is almost as important as the chemical itself. You'll be glad to know that Wyandotte has a research staff whose job is to see that you get all the technical assistance you require.

Shoes courtesy Converse Rubber Company, Malden, Massachusetts.

Soles grip better, wear longer!
Can YOU use PURECAL T profitably?

Treat Wyandotte PURECAL*T exactly as you would a carbon black, and get these improved properties:

Kids give shoes an awful beating. "Cowboys-and-Indians" can grind shoes on hard concrete, test them on slippery roofs, tear them on sharp rocks.

The Problem: A manufacturer wanted to build more safety, tear-resistance, and wear into rubber soles.

The Solution: *Reformulation, using Wyandotte Purecal T, an ultrafine reinforcing filler — not as an ordinary calcium carbonate, but exactly as they had been using carbon black.*

The Results: Soles with extreme flexibility; good grip on slippery, dangerous surfaces; and unusually long life.

If you use a GR-S; some other synthetic elastomer with poor pure-gum properties; or natural rubber . . . *you* can enjoy these improved properties, PLUS these production advantages:

Purecal T gives you building tack in an all GR-S stock . . . it promotes knitting.

Purecal T lessens "nerve," makes smoother stocks, extends GR-S.

Purecal T has high abrasion resistance for a calcium carbonate . . . approaches that of the best clays.

Purecal T is snow-white . . . non-discoloring.

Purecal T is one of Wyandotte's family of precipitated calcium carbonates. Do you have any production problems that Purecals might improve or that our technical service may help you with? Write to *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in Principal Cities.*

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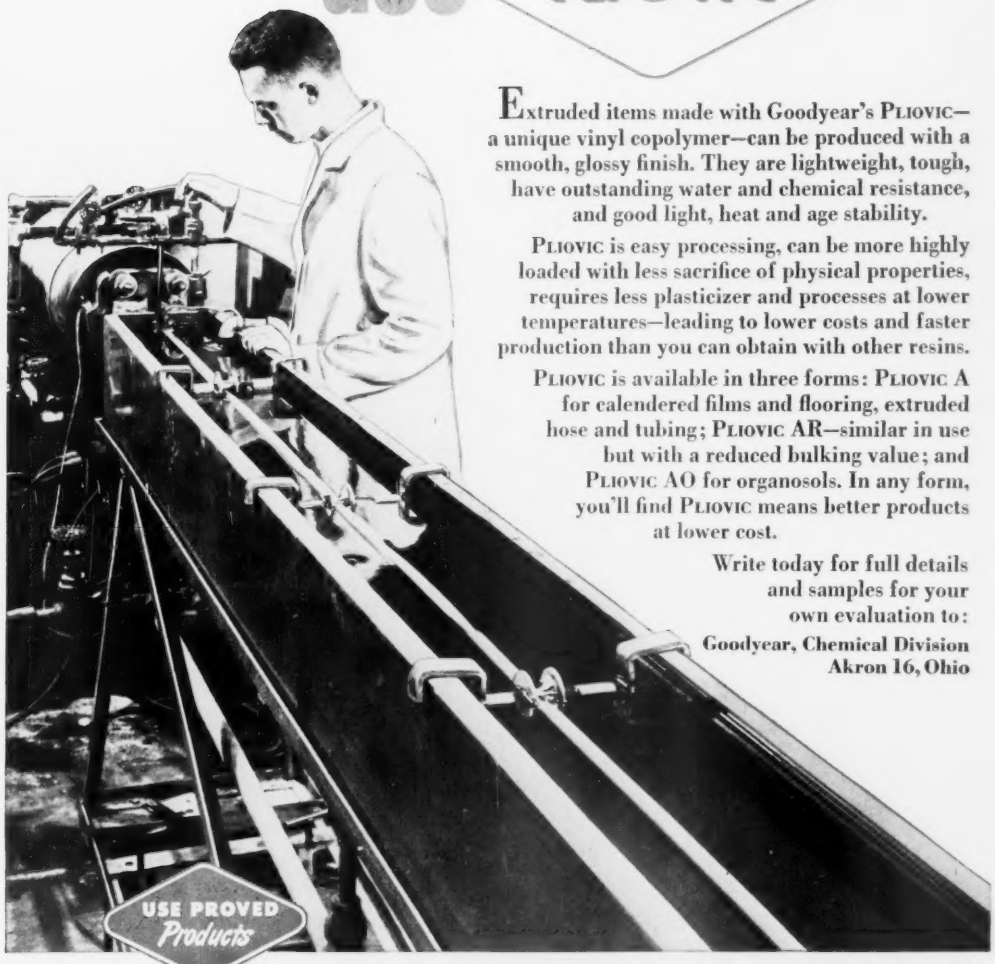
Wyandotte
CHEMICALS

For better extrusions use PLIOVIC



Extruded items made with Goodyear's PLIOVIC—a unique vinyl copolymer—can be produced with a smooth, glossy finish. They are lightweight, tough, have outstanding water and chemical resistance, and good light, heat and age stability.

PLIOVIC is easy processing, can be more highly loaded with less sacrifice of physical properties, requires less plasticizer and processes at lower temperatures—leading to lower costs and faster production than you can obtain with other resins.

PLIOVIC is available in three forms: PLIOVIC A for calendered films and flooring, extruded hose and tubing; PLIOVIC AR—similar in use but with a reduced bulking value; and PLIOVIC AO for organosols. In any form, you'll find PLIOVIC means better products at lower cost.

Write today for full details and samples for your own evaluation to:

Goodyear, Chemical Division
Akron 16, Ohio

GOODYEAR

Pliovic—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

all the bounce

and color, too...

From rubber balls to balloon tires . . . natural rubber or synthetic . . . whiter, brighter rubber products are gained with Titanox pigments. Compatible with all types of rubber, Titanox pigments add quality by imparting maximum brightness and opacity to white or tinted products while maintaining natural strength and life.

For pure gum and lightly loaded stocks, TITANOX-A and TITANOX-RA assure desired whiteness or brightness at minimum loading, thus maintaining flexibility. For heavily loaded stocks specify TITANOX-RCHT, the extended pigment preferred for economical whiteness and brightness. Latex rubber articles are best pigmented with TITANOX-A-LO or TITANOX-AWD, both exceptionally stable and readily dispersible to yield smooth, strong films.

If you have a pigmentation problem Titanox Technical Service is always available. See your Titanox representative or write Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

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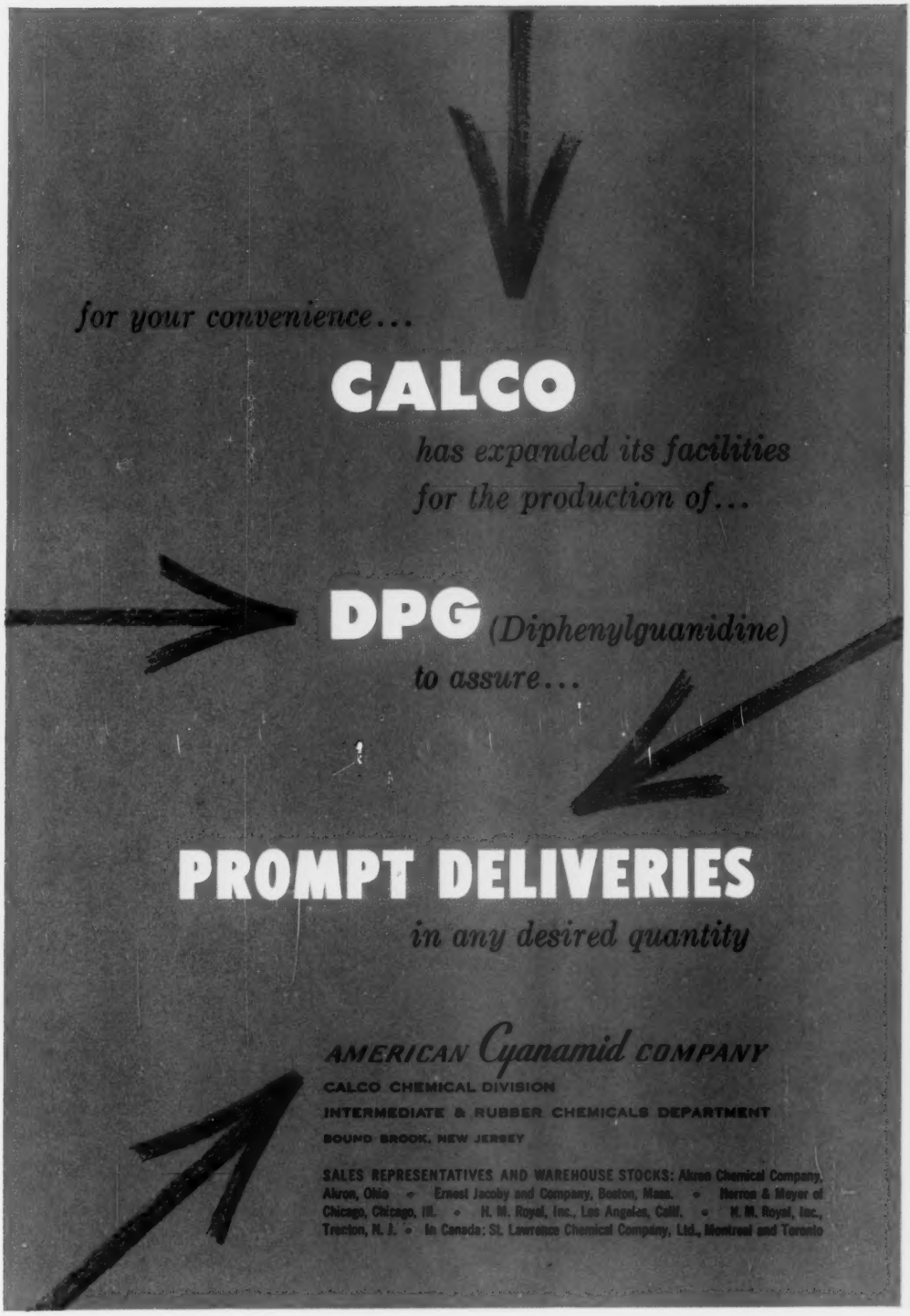
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the truth about Dow Corning Silicones...

. . . is more fantastic than the patter of the pitchman or the spiel of the barkers that doubled in advertising and sales a generation ago. For example:

- Silicone (Class H) electrical insulation makes motors and other kinds of electrical equipment last 10 times as long as they ever did before.
- These same insulating materials are used to double the power per pound ratio in electric machines.
- Silastic,* the Dow Corning silicone rubber is used to seal hot air at 600°F., hot oil at 350-400°F., limit switches and bomb bay doors at −100°F.
- Dow Corning Silicone oils and greases make permanent lubrication a practical reality.

To many engineers and executives, such silicone facts as these still sound too good to be true. That's why we have built and assembled 16,000 pounds of demonstration units and typical applications to prove that our silicone products will do all that we claim for them. This is the first comprehensive Silicone Exposition ever assembled. Previewed in Washington, D. C. during the week of October 22nd, this exhibit will be given private showings in major industrial centers across the country.

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Makes the
Big Difference
in INDUSTRIAL
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MT. VERNON FABRICS
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Shown here is one of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products. Here yarn tensile strength is being determined with 300-lb. vertical test.
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IN LIMITED SUPPLY WITHOUT RATINGS

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Highly compatible with GR-S, Neoprene, Buna N's and Natural Rubber. Imparts excellent low temperature flexibility and resilience. It is both economical and efficient.

TP-95

For plasticizing Buna N rubbers, GR-M and vinyl resins. Imparts excellent low temperature flexibility or good heat resistance. It is economical and efficient.

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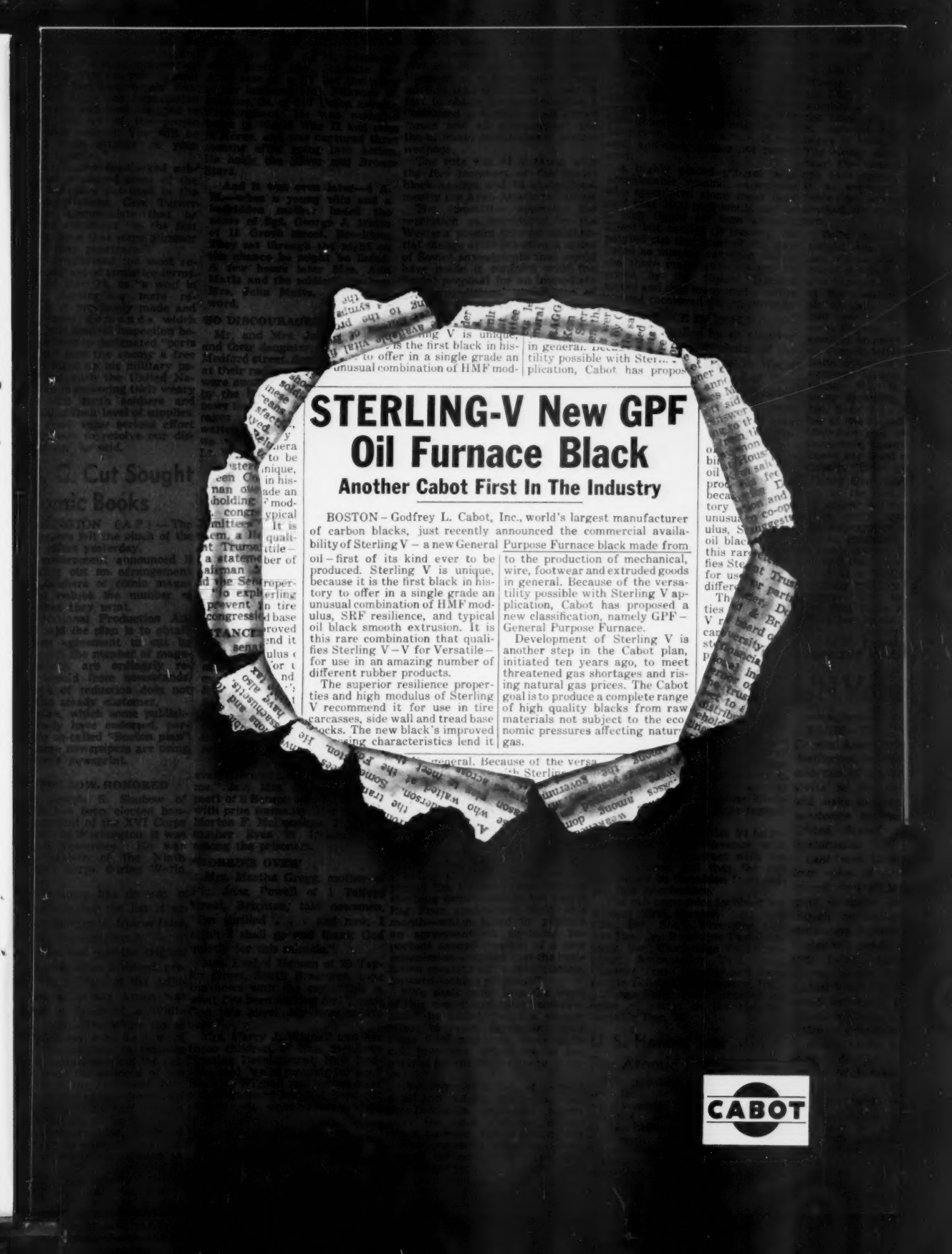
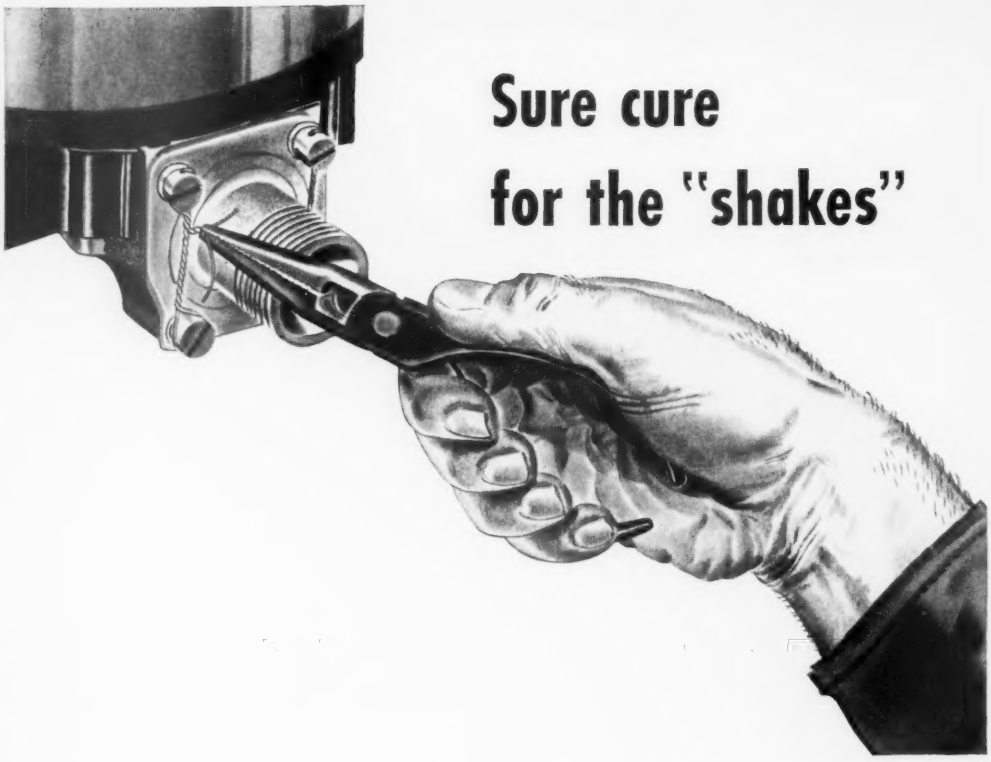

STERLING-V New GPF Oil Furnace Black
Another Cabot First In The Industry
BOSTON – Godfrey L. Cabot, Inc., world's largest manufacturer of carbon blacks, just recently announced the commercial availability of Sterling V – a new General Purpose Furnace black made from oil – first of its kind ever to be produced. Sterling V is unique, because it is the first black in history to offer in a single grade an unusual combination of HMF modulus, SRF resilience, and typical oil black smooth extrusion. It is this rare combination that qualifies Sterling V – V for Versatile – for use in an amazing number of different rubber products.
The superior resilience properties and high modulus of Sterling V recommend it for use in tire carcasses, side wall and tread base stocks. The new black's improved processing characteristics lend it to the production of mechanical, wire, footwear and extruded goods in general. Because of the versatility possible with Sterling V application, Cabot has proposed a new classification, namely GPF – General Purpose Furnace.
Development of Sterling V is another step in the Cabot plan, initiated ten years ago, to meet threatened gas shortages and rising natural gas prices. The Cabot goal is to produce a complete range of high quality blacks from raw materials not subject to the economic pressures affecting natural gas.
CABOT



Sure cure for the "shakes"

UNDER the terrific vibration of aircraft engines, screws and nuts have a tendency to become loose. That's why Army, Navy and Air Corps specifications call for safety wiring on engine mountings, instruments, gun sights, magnetos . . . *every* place on a plane where a screw or nut might shake loose.

By simply drawing the lock wire through a small hole in each nut or screw, and then twisting tightly with pliers, a positive sure cure for the "shakes" is provided.

Wire for this important function must be highly resistant to corrosion, tough enough to resist fracturing under the heat and vibration of aircraft engines, and soft enough to twist with pliers for quick assembly and replacement of parts. Here at National-Standard we've developed a type of slow-annealed stainless steel wire to fully meet these exacting requirements. And we're drawing millions of feet of this wire, not only for aircraft but also for many other automotive applications.

Developing special wire for special purposes has been an important part of National-Standard's business for more than 45 years. Perhaps our unique engineering and manufacturing facilities can help you with your wire and wire fabricating problems.

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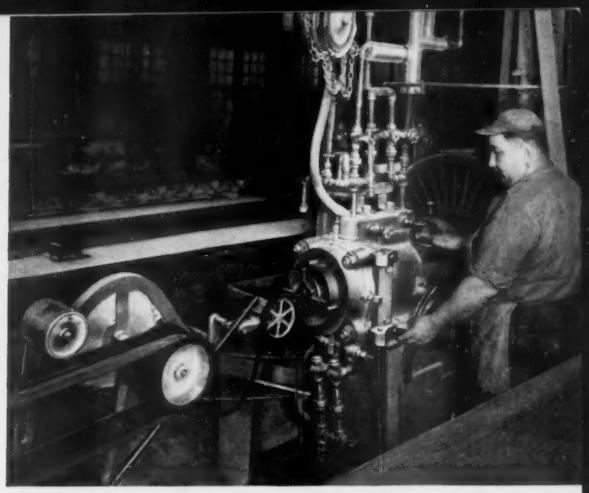
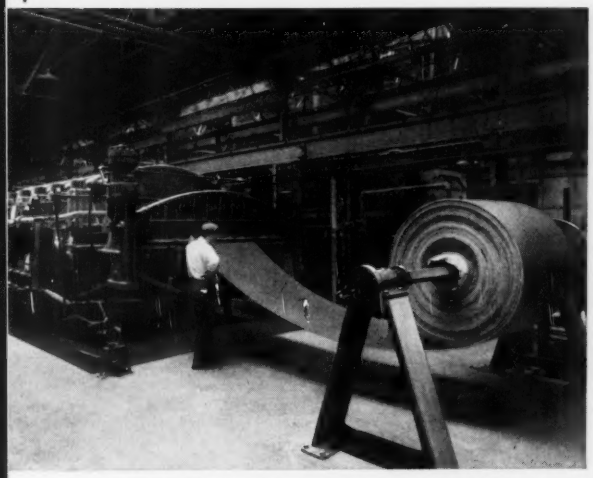
WORCESTER WIRE WORKS	*Worcester, Mass.*	Round and Shaped Steel Wire, Small Sizes

A TOY COMPANY saves $18,000 a year by using a Sun Rubber-Process Aid. Rejects due to blooming have been eliminated. Plasticization has improved so much that toys can now be molded in more intricate designs and with more eye-appeal.



A MANUFACTURER OF MECHANICAL RUBBER GOODS eliminated costly rejects due to scorching, by switching to a Sun Rubber-Process Aid. By properly conditioning his stock—making it easier to work—the Sun aid speeded up extruding.



A MANUFACTURER OF INDUSTRIAL BELTS improved the quality of his products and cut his inventory costs $6,000 a year by replacing five competitive aids with two Sun Rubber-Process Aids. Now able to buy tankcar lots, he saves still more.

A RUBBER SPONGE MAKER changed from ordinary processing oils to a Sun Rubber-Process Aid because it did not migrate, bloom, or affect his reclaim resin-type adhesives. This extra margin of safety has greatly accelerated production.

HOW 4 MANUFACTURERS HAVE BENEFITED FROM SUN'S RUBBER-PROCESS AIDS

By switching to Sun Rubber-Process Aids, each of these four manufacturers increased the efficiency of his plant, improved the quality of his products, and effected substantial savings. The results, condensed into a few words here, are typical, not unusual. Full information on request. More and more manufacturers are turning to Sun "Job Proved" Process Aids to cut costs, speed production, improve quality. The services of a Sun technical representative are yours for the asking. Just call the nearest Sun Office or write to Department RA-7.

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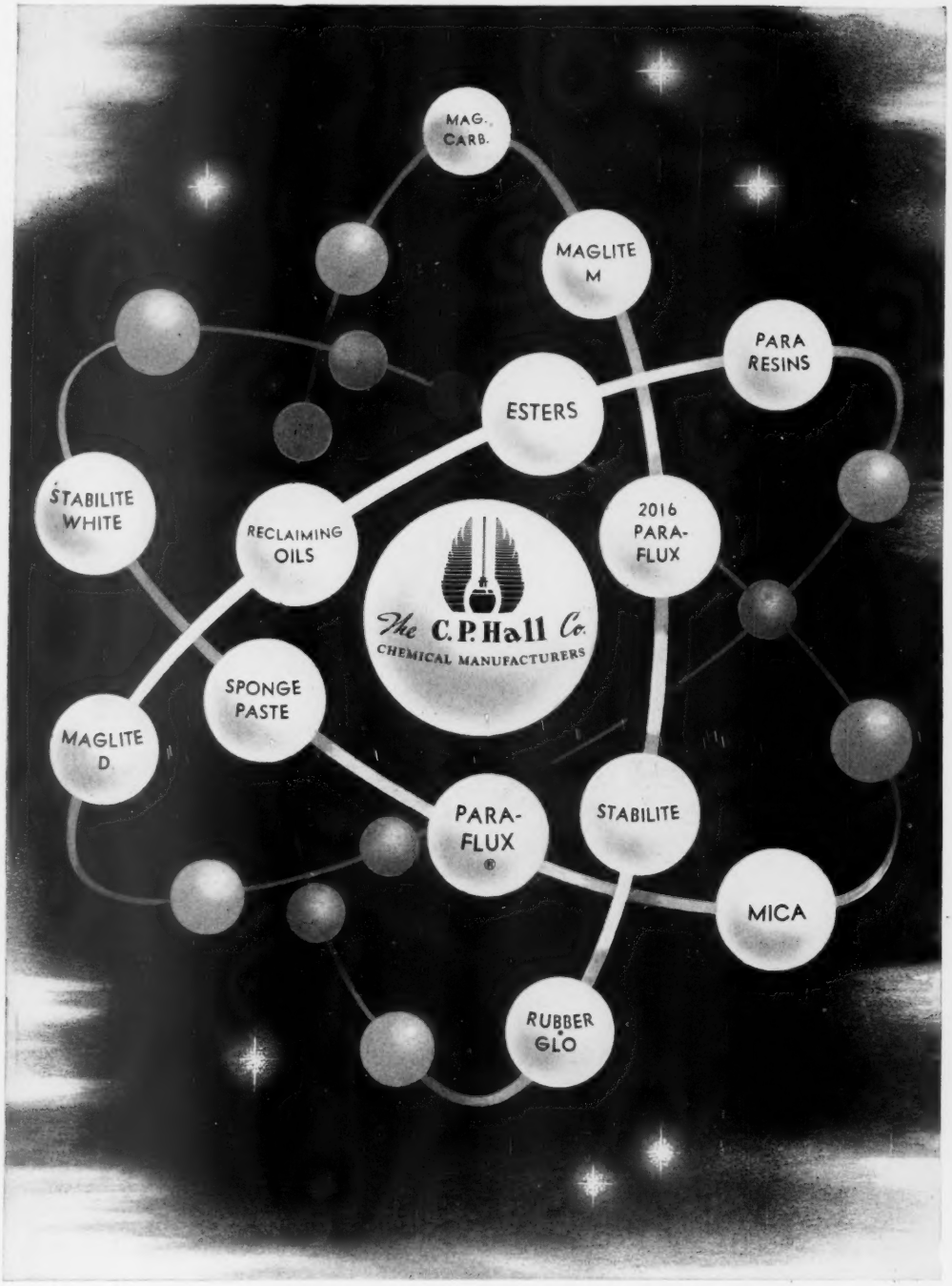

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WITH ALL THESE ADVANTAGES

Low Compounding Cost	**High Reinforcement**
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Standardize on KOSMOS 40 — a high modulus furnace black (HMF) for good economy, outstanding performance and all-around satisfaction.

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. . a group of aromatic Petroleum Solvents

NEVSOLV aromatic Petroleum Solvents are available in a number of different distillation ranges from low boiling to high boiling. In addition to the standard distillation ranges, we invite inquiry on special fractions to meet your particular requirements. NEVSOLV Solvents are manufactured to rigid specifications, insuring high solvent power, constant evaporation rates and negligible residue.

Write for samples and further information on these uniform Neville solvents.

THE NEVILLE COMPANY

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Plants at Neville Island, Pa., and Anaheim, Cal.

Part of Neville's current expansion program is this new plant recently completed at Neville Island, for the production of NEVSOLV Solvents

A-43

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Processed LINERS

because they:

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- ★ **Greatly outwear ordinary liners**
- ★ **Preserve tackiness of the stock**
- ★ **Eliminate lint and ravelings**
- ★ **Permit horizontal storage**

These and many other proven advantages of Climco Processing save time and money by eliminating down-time, speeding production, protecting stocks and reducing liner replacements. Since 1922, leading rubber companies have found that Climco Processing repays its moderate cost many times over. Give them a trial in your plant.

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SERVING THE RUBBER INDUSTRY FOR 30 YEARS

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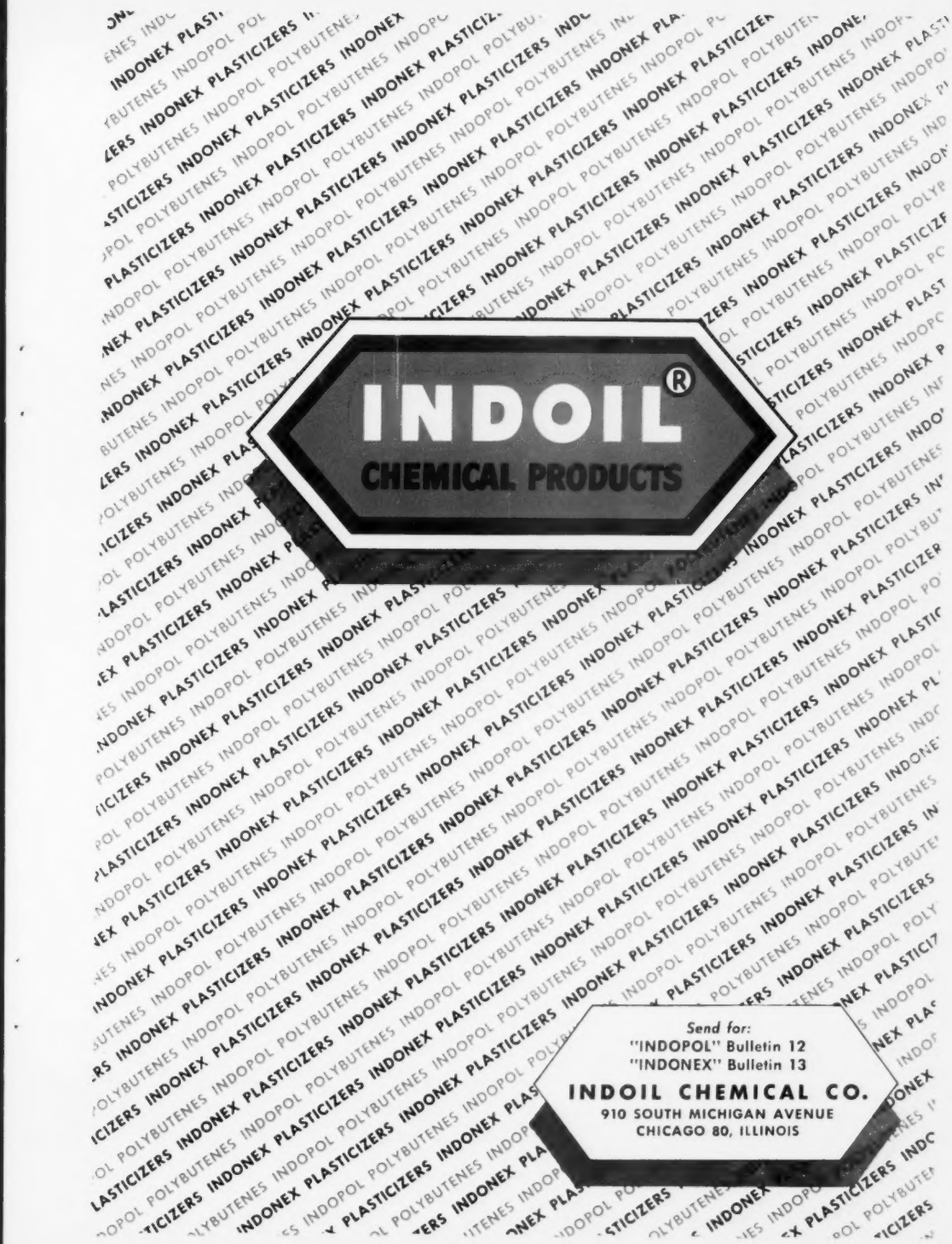
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Six Million Malayans

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They Share Your Faith in Democracy

They are for freedom of speech, religion and enterprise. Their new Federation of Malaya is the "United Nations" idea at work, with Asians and Europeans working together to build a new country. Malaya is a keystone for democracy and a barrier against the spread of Communism in Southeast Asia.

You Are Their Best Customer

Six million Malayans must export to live. And 85% of their income from exports comes from rubber and tin, sold mostly to America.

Rubber Is Their Chief Cash Crop

They sell it on a free market, but, as allies of democracy, have banned exports to Red China. Rubber is grown by 350,000 independent rubber farmers as well as by more than 1,000 large rubber plantations. Production has been maintained in spite of constant attacks by Red bandits. This rubber has made possible America's present strategic stockpile.

The Rubber Planter Has Fought the Reds for Four Years

Regular army and police forces, 100,000 strong, have been holding Malaya against Red aggression for four years. SO HAS THE RUBBER PLANTER. His plantation is the front line in the fight against Communism in vital Southeast Asia.

This advertisement published by the

Natural Rubber Bureau

1631 K STREET, N.W., WASHINGTON 6, D.C.

to promote greater understanding in America of its friend, ally, and supplier in Southeast Asia — the Malayan rubber grower. Write for free booklet — "NATURAL RUBBER AND YOU."

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zinc oxide

AZO ZZZ-55

Uniform particle size and absence of extreme "fines" assures good dispersion and easy processing.

*** AMERICAN ZINC SALES CO.**

Distributors For

AMERICAN ZINC, LEAD & SMELTING CO.
COLUMBUS, O. CHICAGO
ST. LOUIS, MO. NEW YORK

U.S. RECLAIMS produce CAMELBACK

★ EASIER ★ FASTER ★ CHEAPER . . . with no sacrifice of QUALITY!

Manufacturers of camelback, as well as many other types of rubber products, have found that Dip-Process Reclaims are the answer to easier, faster, lower cost processing.

U. S. Dip-Process Reclaims are particularly suited for use with "cold" rubber and oil-enriched GR-S because of their low Mooney plasticity. Now you can achieve easier processing, shorter mixing time, faster extrusion and LOWER COMPOUND COSTS and *still maintain your original quality!* Why not add your company name to the list of enthusiastic users of Dip-Process Reclaims, who have discovered that the greater plasticity of these unique reclaims STABILIZES quality by permitting the use of RUBBER ITSELF as a plasticizer.

Whether you produce CAMELBACK or any one of the hundreds of different rubber products that require reclaims with a high degree of plasticity, we would like to send you full details on our complete line of Dip-Process Reclaims. Why not drop us a line?

Always keep reclaims in your formula and always look to U. S. for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

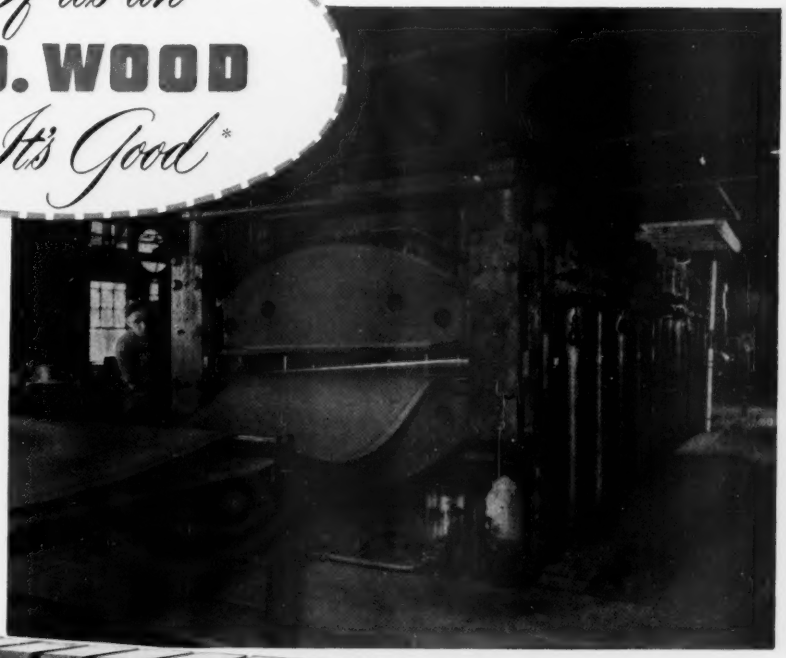
69 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.

If it's an

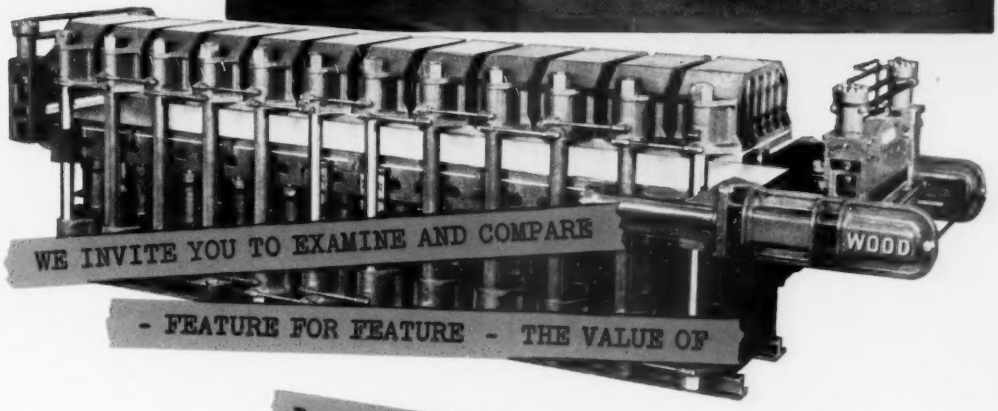
R. D. WOOD

*... It's Good**



3,180-ton single opening hydraulic belt press used for vulcanizing rubber belting. Twenty-four cylinders are arranged in pairs which can be cut out at any time, or can be removed from the press without dismantling any other part.

Hydraulic stretcher and clamping units are mounted at the ends of the moving platen which measures 63¼" x 30' x 3¾".



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ACTIVATOR NEWS

HORSE HEAD PRODUCTS

A supplement to THE ACTIVATOR—the house organ issued by The New Jersey Zinc Company for over 15 years to aid the Rubber Industry in its use of Zinc Oxide.

PROPIONATE COATING ADDS NOVEL FEATURES TO ZINC OXIDE

Rubber compounders and production men alike, in recent years, have helped to write a new chapter in the book of zinc oxide knowledge. For they have found, as they increased their use of zinc propionate coated zinc oxide, that this pigment—Protox-166*—has some advantages not available in untreated oxide.

Several of those features of Protox-166 have been described in detail in previous issues of ACTIVATOR NEWS, and others will appear here later. For your convenience, the list of such properties is shown in the attached table. If you have not yet evaluated Protox-166 in your compounds, we shall be glad to send you samples.

PROTOX-166 GIVES YOU ALL THESE ADVANTAGES

(COMPARED WITH ZINC OXIDES NOT OF THE PROTOX TYPE)

FEATURES OF PROTOX-166	HOW YOU PROFIT
LOWER DRY BULKING	LESS STORAGE SPACE LARGER BATCHES MORE OUTPUT
LOWER MOISTURE PICKUP	FASTER MIXING
ORGANOPHILIC COATING	QUICKER INCORPORATION BETTER DISPERSION LOWER POWER CONSUMPTION EVEN ACTIVATING AMOUNTS SPEED MIXING OF CARBON BLACKS
SCORCH INHIBITION	MORE PRODUCTION
PLASTICIZING EFFECT	FASTER, SMOOTHER TUBING AND CALENDERING REDUCES DIE SWELL CUTS CALENDER SHRINKAGE GIVES COOLER-RUNNING STOCKS
HIGHER REINFORCEMENT	IMPROVED TENSILES BETTER TEAR RESISTANCE HIGHER MODULUS GREATER RESILIENCE
MINIMUM PROGRESSIVE CURE, EVEN WITH PERSISTENT ACCELERATORS	LONGER SERVICE LIFE

*U. S. Patents 2,303,329 and 2,303,330

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments

... most used by rubber manufacturers since 1852

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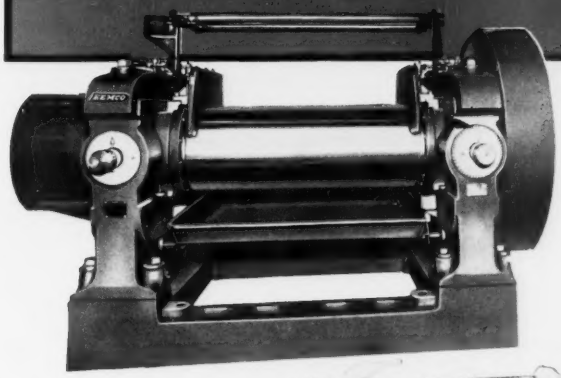

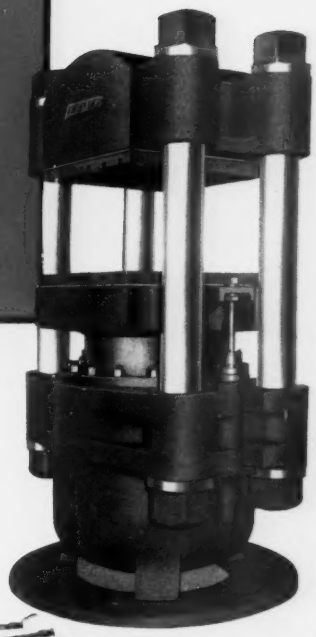

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(Complete range of sizes)

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Send for latest mill and press folders. Compare price, performance and shipment of EEMCO rubber and plastics processing machinery before you buy.

EEMCO *Erie Engine & Mfg. Co.*

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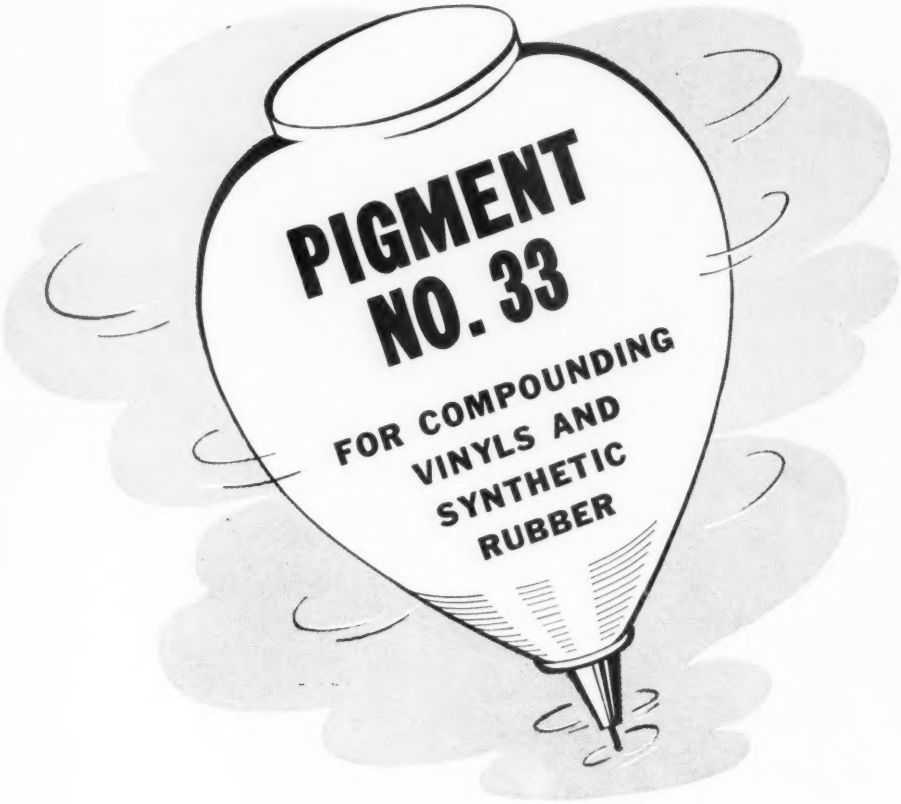
RUBBER AND PLASTICS MACHINERY DIVISION

IT'S "TOPS"



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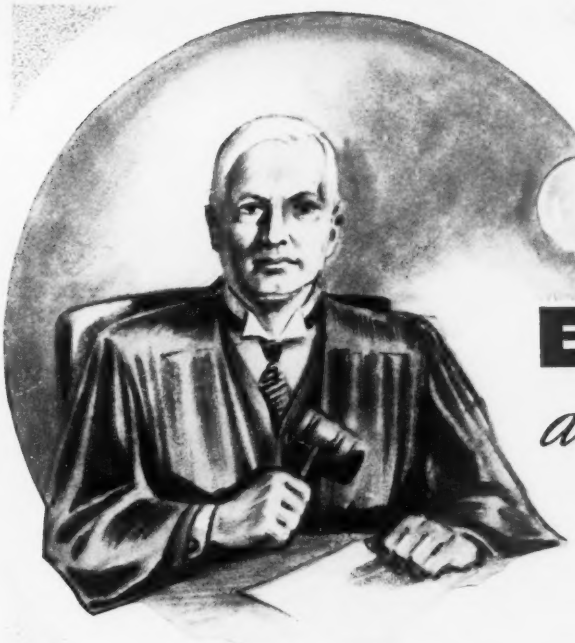

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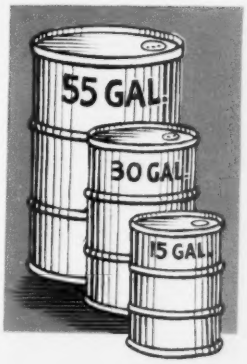
on what GLYCERIZED (LIQUID CONCENTRATE) LUBRICANT

WILL DO FOR YOU

Investigate these **FACTS**

Prevents adhesion of hot rubber slabs when piled . . . banishes dust nuisance by replacing soapstone or talc . . . prevents sticking during cure of extrusions and flat pan coiled tubing . . . excellent release agent for molds, mandrels, air bags, belt drums . . . equally satisfactory for washing and finishing inner tubes; imparts satiny finish . . . greatly aids in the processing of insulated wire and cable. The Production Departments and Laboratories of many rubber manufacturers, through years of using GLYCERIZED, give ample proof of its outstanding qualities as a lubricant for natural, synthetic and reclaimed stocks. Write for sample on your letterhead, then evaluate. You are the judge of the results.



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RUBBER MATERIALS DIVISION

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COOKE

DISPERSED RUBBER

COLORS

give you **TOPS** in color value

Send for your copy of this color chart today.

COOKE COLORS ARE BEST BY COMPARISON

COOKE COLORS are furnished as soft dispersions of organic toner and neutral polymer. They are unsurpassed for aging properties and will stand long storage and temperature changes. COOKE COLORS have high tinctorial value and give a clean, bright tone to the finished product.

These are quality colors for use in natural or synthetic rubber and in vinyls. They will stand all cures, are non-bleeding, and assure an *exact* color control of your products. COOKE COLORS are unmatched for depth of tone, high stability, permanence, and ease of handling.

There are over 20 standard colors in the COOKE line—a color for every job. If the shade you need is not on our color chart, the colors can be blended to achieve precisely the shade you want. Or, if you prefer, we will supply reproducible blends to meet your individual requirements.

Cooke

COOKE COLOR & CHEMICAL CO.
GLEN ROCK, NEW JERSEY
Plant and Laboratory: Hackettstown, N. J.

Development of this .0017-inch film is of particular interest for the packaging and protective materials fields as well as for household applications of film such as draperies, since it affords the economy of a thin film while still retaining the advantages of a calendered product. It is available from Ross & Roberts in a variety of colors and widths.

.0017-INCH UNSUPPORTED VINYL FILM

Produced On Farrel Z-Type Calender

Now, for the first time, 1.7 gauge, calendered, unsupported vinyl film is being produced on a commercial scale. The manufacturer, Ross & Roberts, Inc., of Stratford, Connecticut, credits the development of this exceptionally lightweight film to new techniques in calendering and to Farrel-Birmingham's Z-type calender.

The Z-type four-roll calender was designed by Farrel-Birmingham for just such precise production as this—production that demands extreme accuracy of gauge and temperature control. The verigraph charts show how consistently the required gauge can be maintained by this machine in running vinyl film.

In addition to unsupported plastic film, Z-type calenders are ideally suited for producing sheet and for single and double coating. They are available in a wide range of sizes, from small experimental machines to large production sizes.

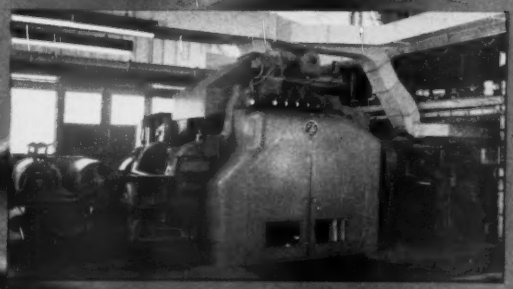
Farrel-Birmingham engineers will be glad to discuss your calendering requirements with you at any time. Or, for general information about Farrel-Birmingham rubber and plastics calenders, send for a copy of new 32-page bulletin, No. 174.

FARREL-BIRMINGHAM CO., INC., ANSONIA, CONN.

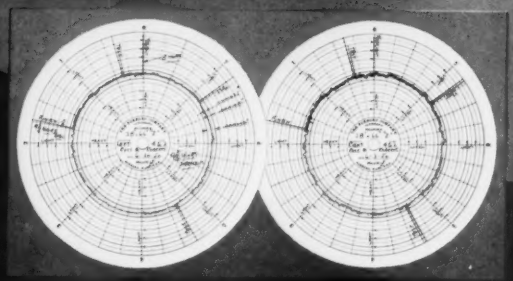
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

FB-684



Farrel-Birmingham, 28" x 66", Z-type, four-roll calender installed in the Ross & Roberts plant.



Verigraph charts showing extreme accuracy of gauge in running vinyl film on a Z-type calender. The variation is less than plus or minus .0001 inch.

STICKS...
like a shadow
on a sunny day!

TY·PLY

the finest Rubber-to-Metal Adhesive

TY-PLY **Q** for bonding Natural, GR-S, and Butyl

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TY-PLY **BN** for bonding N-types

TY-PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface.

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TY-PLY has stood the test of time....since'39

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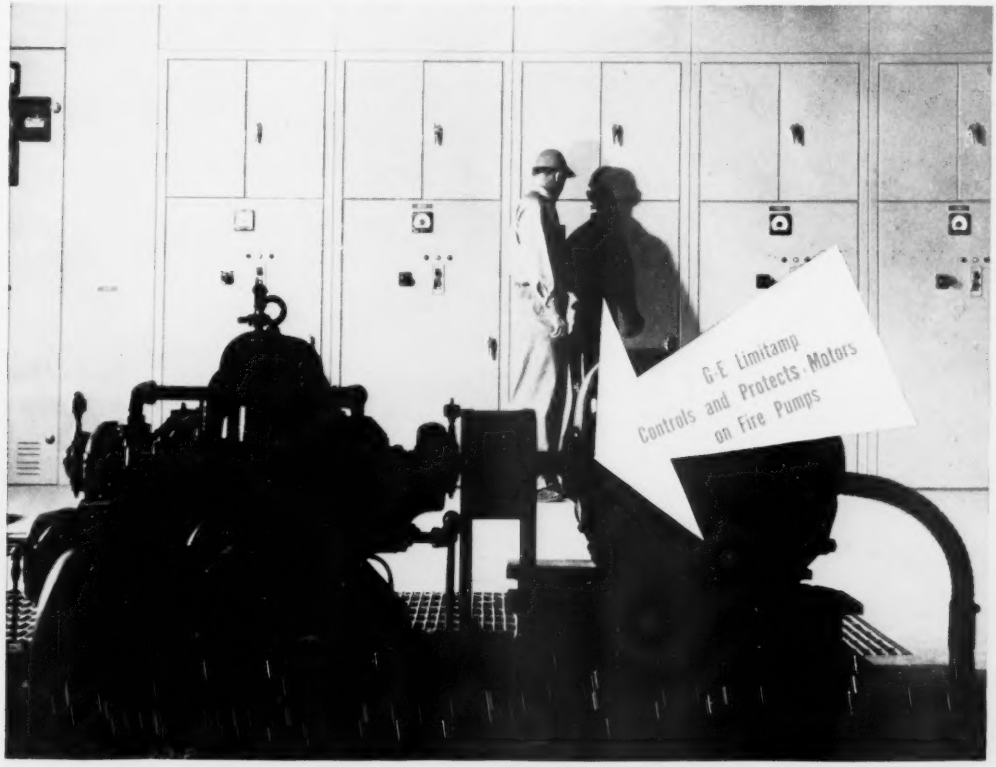

G-E Limitamp provides high-voltage control for five pump motors totalling pumping capacity of 17,000 gallons a minute at N. Y. International Airport

This fast-acting control is expected to put motors of 210 and 350 horsepower into immediate action in case of fire at the airport. Designed for heavy duty; corrosion resistant, and containing no complicated mechanism, Limitamp requires only routine maintenance—is always ready to go into operation.

Chosen for its high interrupting capacity and comparatively low cost, pre-engineered and factory assembled G-E Limitamp guards equipment against the ravages of short-circuit currents. G-E developed EJ-2 fuses interrupt the circuit within ¼ cycle. This prevents expensive, and possibly dangerous shutdowns.

New compact design of controllers, many protection features, co-ordinated engineering on every job make this the high-voltage control (up to 4800 volts) you need for economy and protection. Write today for Bulletin GEA-5409A.

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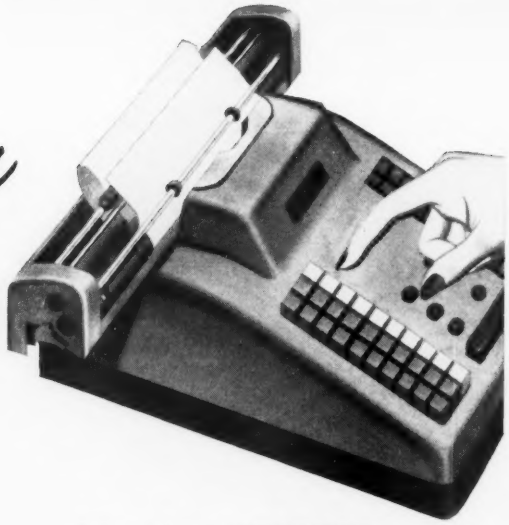

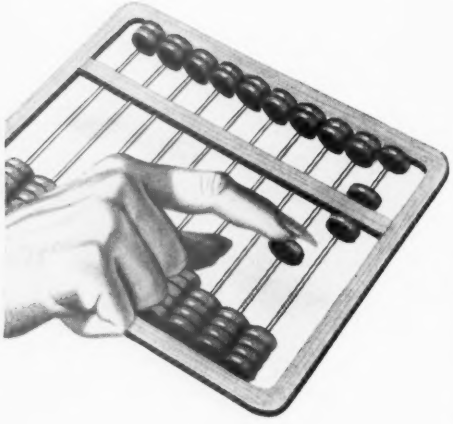

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Check the pound/volume comparison at right to see how SURFEX MM, a controlled quality precipitated calcium carbonate, can help you lower vinyl compounding costs and increase batch yields with no sacrifice in quality.

Write for your copy of "The Application of Inert Fillers in Vinyl Plastics".

YOU GET ALL OF SURFEX MM's ADVANTAGES AT NO EXTRA COST

	COST/LB	RECIPE	
PVC RESIN	$0.38	100	100
DOP	.42	57	57
SURFEX MM	.0185	35	
W-G Limestone	.009		34
Stabilizer	.57	3	3
Lb./Volume Cost		45.2c	45.2c
Durometer Hardness		85	85
Tensile		2400 psi	2200 psi
Crescent Tear		400 lbs/inch	350 lbs/inch

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Do you need new **color and lasting beauty for the products you manufacture?**

See what one of Naugatuck's Marvinol Rigids has done with a protective covering for steel tubing. We think that this product—with its resistance to abrasion, corrosion, and flame—will interest you.

The plastic armor Marvinol has created here is called Dekoron®. It is a product of Samuel Moore & Co., Mantua, Ohio. You'll soon see it on stanchions, overhead rails, and seat grab rails of busses. There it sheathes common metals and improves their performance, feel, and appearance—makes them real passenger pleasers.

This Marvinol-based Dekoron comes in brilliant colors which are solid through and through. Their delightful, easy-to-clean color and beauty *will never wear off.*

With the new eye appeal of this Marvinol Rigid, you also get improved structural strength. Neither dirt nor perspiration can harm it. And it feels warm in cold weather, cool in warm weather. Here is highest product quality—*at no premium in cost!*

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These versatile Marvinol resins—quick to process, uniform in quality—come to you from Naugatuck Chemical. Write on your company letterhead for the facts on Marvinol to the address below.

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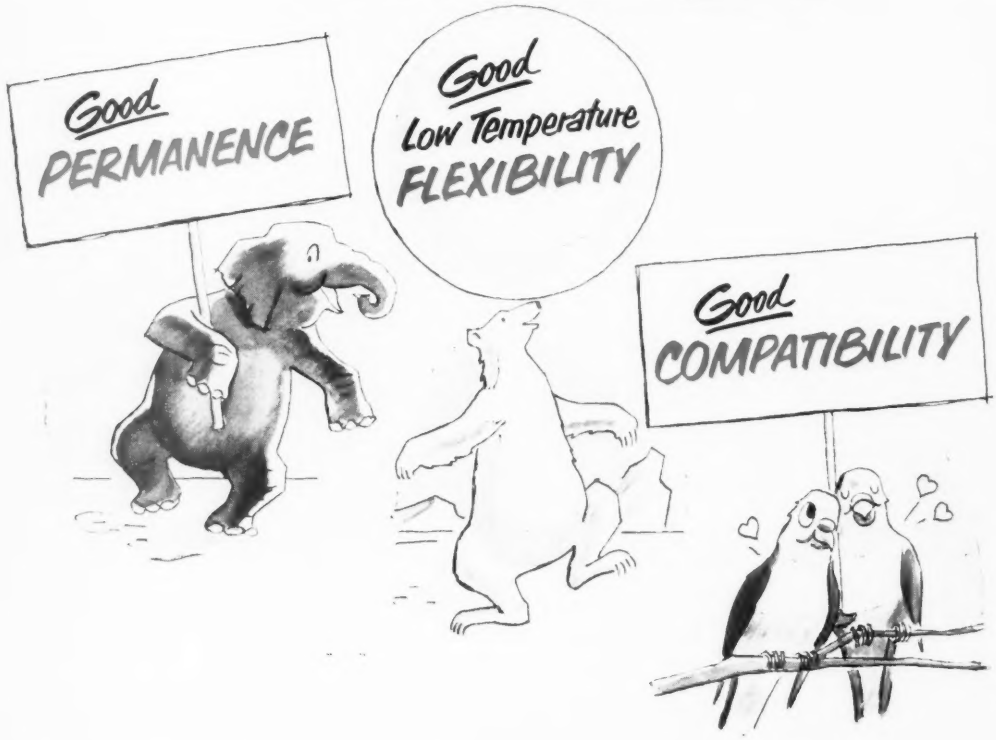

Pittsburgh PX Plasticizers give you the high degree of permanence, low temperature flexibility and compatibility you want in your plastic products. And you can *depend* on these advantages in every shipment.

As a basic and integrated producer, we're able to closely control the quality and uniformity of Pittsburgh PX Plasticizers from coal to finished product—a factor that assures you better performance and more consistent results.

Because of the great demand for plasticizers today for both military and civilian use, we're expanding our production facilities to help meet these needs. We'll be glad to send you samples and specification sheets or provide any technical assistance you require. *Write today!*

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PX-108	DiIsoOctyl Phthalate
PX-138	DiOctyl Phthalate
PX-208	DiIsoOctyl Adipate
PX-238	DiOctyl Adipate
PX-404	DiButyl Sebacate
PX-408	DiIsoOctyl Sebacate
PX-658	TetraHydroFurfuryl Oleate
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WBD 1953

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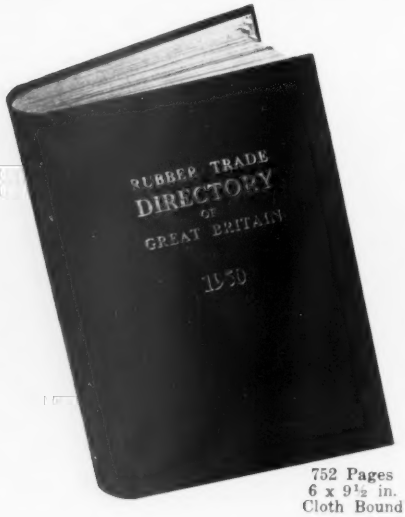

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FIRST EDITION

1950 RUBBER TRADE DIRECTORY of GREAT BRITAIN

AVAILABLE NOW

Here for the first time is a Directory of the rubber industry in Great Britain providing complete details on all branches of the manufacturing field, as well as on suppliers of chemicals, machinery, etc.

As an added convenience, both the Table of Contents and the Classified Index are printed in English, French, German and Spanish.

Basically patterned after the RUBBER RED BOOK, the 1950 RUBBER TRADE DIRECTORY OF GREAT BRITAIN was compiled by the staff of the India-Rubber Journal (London).

This directory is sold in the United States and Canada by RUBBER AGE and is available for immediate delivery.

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While the demand for IONOL currently exceeds production capacity, it will pay you to give serious consideration to its advantages in your product development planning.

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speeds processing, improves physicals of GR-S and natural rubber sole stocks!

- eliminates need for zinc oxide and accelerators in using basic fillers (Silene, etc.)
- oil resistant, light colored
- reaches optimum cure in 10 min. at 325° F.

TYPICAL TEST FORMULATIONS

	Formula #83	Formula #84
GRS (X631)	100	100
Sulphur	3	3
Silene EF	75	75
Neozone D	1	1
SUBLAC PX-5	30	30
Polymel C-130 Resin	—	5

NOTE—no zinc oxide or accelerators in these compounds

. . . AND TEST RESULTS

10 Min. Cure at 325° F.

Tensile psi	1200	1200
Elongation %	250	280
Modulus @ 200%	990	850
Hardness	81	83

ALSO PREVENTS SCORCH IN NEOPRENE!

10 parts of Sublac PX-5 on the rubber acts as a co-accelerator in all non-black neoprene stocks and prevents scorch in both process and bin storage stocks.

Sublac PX-5 also gives a preservative quality to unvulcanized neoprene stocks.

TEST SUBLAC PX-5 YOURSELF, FREE!

Write today for 5 lb. sample and test data. Once you've tried Sublac PX-5 in your own stock, you'll agree it's the biggest development yet in modern rubber processing.

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to extend and improve your rubber compounds *

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Completely compatible and economical filler, extender or softener . . . facilitates faster and smoother processing of stocks with good physical characteristics . . . gives high resistance to accelerated aging. Manufactured in Witco's plants at Lawrenceville, Ill., and Perth Amboy, N. J.

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Used in high loadings to extend and to reinforce the rubber hydrocarbon, Witcarb R (ultra-finely divided precipitated calcium carbonate) has a definite reinforcing action in non-black stocks . . . improves tensile, tear and abrasion resistance in natural, synthetic, and natural reclaim rubber stocks.

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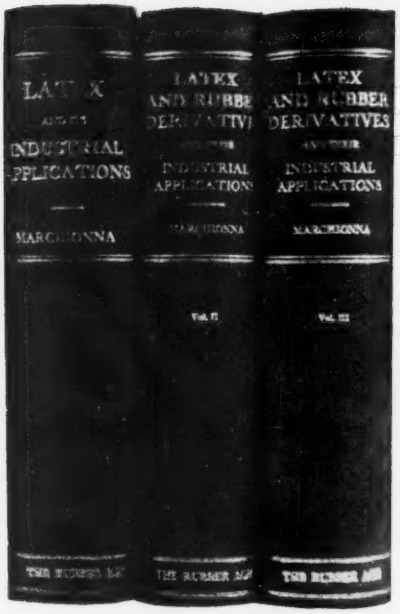

LATEX AND RUBBER DERIVATIVES

by Frederick Marchionna

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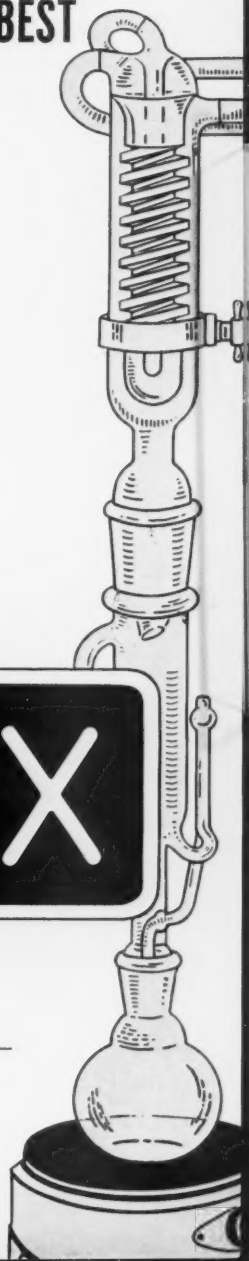

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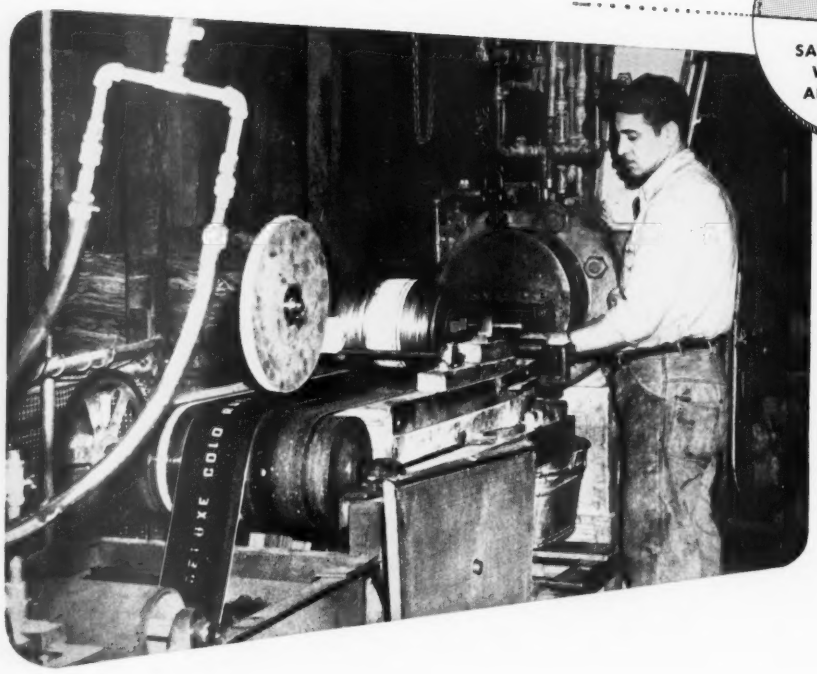

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Studies in the Dispersion of SRF Carbon Black in Butyl Rubber

By F. P. FORD and A. Y. MOTTLAU

Standard Oil Development Co., P. O. Box 51, Linden, N. J.

A simple method is described for producing different degrees of carbon black dispersion in elastomers under controlled laboratory conditions. Careful selection of milling conditions has made possible the preparation of stocks possessing variations in degree of dispersion comparable to the wide differences noted in practice.

A new technique is described for studying these carbon black dispersions in rubber by means of the electron microscope. Such studies show large differences in degree of agglomeration of carbon black in compounds made under simple variations of conditions. Representative electron micrographs are shown. Good correlation is obtained between these micrographs and light transmission measurements of dilute solutions of the compounds. Such photometric analysis provides a simple method for the measurement of carbon black dispersion in research or control work.

The observed differences in degree of dispersion are shown to have an effect on the physical properties of the unvulcanized compounds. This effect was observed by means of the parallel plate plastometer. The viscosity values obtained with this instrument show a direct correlation with electron micrographic observations.

Some of the practical and theoretical implications of this study are discussed with reference to recent work in this field by other investigators.

THE vital function of carbon black as a reinforcing agent for natural as well as synthetic rubber is familiar to all rubber technologists. As such, the degree and manner of its dispersion is a matter of great importance, and has been the subject of much speculation and experimentation within the industry. For example, the adverse effect of poor carbon black dispersion on tire tread wear has long been recognized, and much effort has been expended to achieve optimum dispersions. In fact, the maximum in physical properties of any compound are realized only with the best possible dispersions.

It is also acknowledged that many factory processing problems are related to carbon black dispersion. Plasticity, processing behavior, and vulcanization rate may be affected by variation in dispersion. The behavior of rubber compounds in milling, extrusion, and calendering operations is influenced by variations in carbon black dispersion. For example, a coarse dispersion frequently results in porous extrusions. Likewise, the important property of "tack" or cohesiveness may be adversely affected by poor dispersion, especially in synthetic rubber stocks.

Examples of such problems may be cited from the early experience in the commercial development of Butyl rubber inner tubes. Probably most of these difficulties can be discounted on the basis of limited experience with a new material. However, a frequent complaint was that unvulcanized tubes were readily distorted during fabrication. Thin spots at the folds were

the most common manifestation of this phenomena. Another source of trouble was in the butt splicing operation where the ends of the flat tube were joined.

These and similar problems suggested that this new synthetic product was not uniform from one lot to another. Exhaustive laboratory and factory scale experiments, however, failed to substantiate this contention. In fact, it was clearly demonstrated that many difficulties, such as those just mentioned, could be traced to variables in factory processing operations. One of the most important of these variables was the degree of dispersion of the carbon black.

The significance of carbon black dispersion is therefore quite apparent. This paper is primarily concerned with new techniques for measurement of carbon black dispersion by means of the electron microscope and the parallel plate plastometer. The electron micrographic results are correlated with plastometric measurements.

Experimental Procedures

Preparation of the Compounds: Experience suggested that variations in carbon black dispersion could be produced in the laboratory by simple and controllable changes in mixing equipment and techniques. Accordingly, five separate batches of a carbon black-synthetic rubber stock were prepared on a 6 x 12-inch laboratory mill. GR-I-15 was selected as the polymer to which 50 parts of a semi-reinforcing furnace black was added. The only variables introduced were the mill roll settings and, consequently, batch size. The roll clearances varied from .010-in. to .070-in. and the batch weights from 75 grams to 600 grams. This appeared to be the simplest manner in which substantial differences could be obtained in the amount of work or shearing action performed on a compound under controlled conditions.

Two simple precautions were necessary to allow the mill nip setting to be the determining factor in the dispersion of pigment particles into the polymer. First, the batch size had to be kept to a minimum so that excessive working of the stock did not take place in the mill bank. Second, the usual blending and cutting of the batch on the mill had to be avoided for similar reasons. The principal variable, therefore, became the gap between the two mill rolls. The mixing was done on a cold mill and was continued only as long as was necessary to completely incorporate the carbon black into the polymer.

The compounds so prepared contained only polymer and carbon black pigment; softeners, processing aids, and other modifiers were avoided. In this way it was possible to obtain a series which varied only in the degree of carbon black dispersion.

These compounds (Figure 1) had some differences which were immediately discernible. The compounds prepared on the tightest mills appeared to be blacker and more shiny than those mixed on more open mills. The former had better "building tack" and were less porous. Compound No. 5 was found to have the poorest dispersion of the series. It would be expected to have the poorest extrusion, forming, and splicing properties. Conversely, the first compound would be expected to process very well in these respects.

In all probability, the five compounds represented the range in degree of carbon black dispersion which might be experienced in commercial processing operations.

The differences between the compounds became more conspicuous when they were prepared as dilute suspensions (.0068% by weight) in petroleum naphtha (Figure 2). The photograph of these suspensions was taken after they had been allowed to settle for three days. Photometric measurements of these suspensions were obtained, before settling, by means of a Diller Colorimeter. The data are shown in Table III.

Several other series of compounds were prepared by the variable mill nip technique and differences were observed in their properties comparable to those described above. It was apparent, then, that a simple, reproducible method had been found for obtaining varying degrees of black dispersion in Butyl rubber. It was therefore desirable to consider other, more accurate, methods of studying such dispersions. The instruments chosen for this work were the electron microscope and the parallel plate plastometer. With the former it is possible to make very accurate observations on the degree of dispersion or disaggregation of carbon blacks in admixture with a polymer. On the other hand, precise measurements of physical properties in the unvulcanized state are possible with the parallel plate plastometer. Both methods have been used in studying the carbon black dispersions. The results obtained are discussed in the balance of this paper.

Electron Microscope Examination: The electron micrography of colloidal carbon in uncured and vulcanized rubber appears to be a subject that has not been

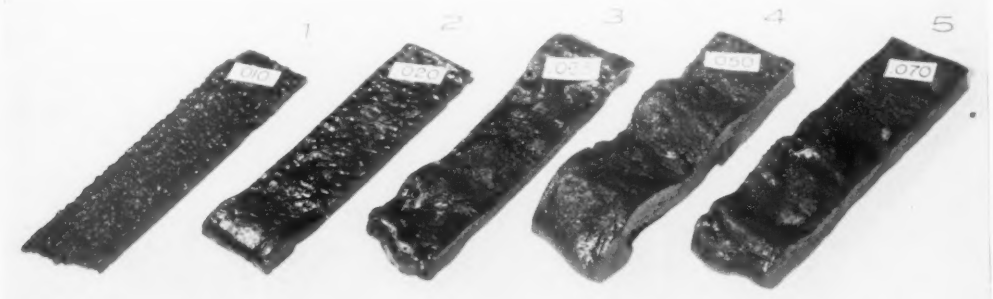

FIG. 1—One-inch wide strips of Butyl-carbon black compounds cut from mill slabs soon after mixing on a conventional 6 x 12-inch laboratory mill. Mill nip settings are indicated by the figures superimposed on the strips.

given very wide coverage in the literature. The most comprehensive work on this problem seems to have been done by Ladd *(6)*. He offers three techniques for the electron micrography of carbon-rubber specimens:

1. The Rub Out Technique wherein the uncured rubber is "rubbed out" on a glass supported Formvar membrane. The membrane is subsequently removed from the glass and mounted on the specimen screen.

2. The Replica Method by which a replica is made of the fractured surface of a rubber black.

3. The Vulcanizing Method in which a small block of uncured rubber mix is placed, under high pressure, between a convex and a plane surface, and then vulcanized. The thin pressed out section of the block is subsequently used as an electron microscope specimen.

The authors felt that none of these techniques would give a true picture of the degree of dispersion. The physical work necessarily applied to the compound by methods 1 and 3 undoubtedly causes further breakdown of carbon black agglomerates, while the replica technique, limited as it is to the representation of a single plane, can give no measure of carbon agglomeration.

Previous experience with the dispersion of reinforcing blacks for electron microscope examination led to the firm conviction that the extensive agglomeration found in these blacks is not due to any unusual attraction between particles, but rather is due to a physical bonding of the particles during their formation. Assuming this concept to be correct, the function of a mill or Banbury mixer can be divided into two distinct parts: (1) Distribution of the carbon black uniformly throughout the mass of rubber, and (2) Reduction, by fracture, of the size of the bonded agglomerates.

Although these two functions undoubtedly occur simultaneously, they can, for purposes of study, be thought of as separate and distinct. The first function, which will be referred to as distribution, can be easily measured by analyzing samples taken from various parts of the mix. The second function, which will be called dispersion, was the one studied by means of the electron microscope.

Considering the large amount of effort necessary to reduce the size of bonded agglomerates by working in a viscous medium, and the fact that it is practically impossible to reduce their size by simply shaking in a liquid medium, it was felt that a solution technique, similar to that used by von Ardenne *(1)* or Hall *(5)*, would give the most satisfactory picture of dispersion. Inasmuch as the distribution of carbon black throughout the mass of a mix can be evaluated, as pointed out above, by a separate means, the only factor to be measured with regard to the dispersion of the black is the degree of breakdown of the bonded agglomerates. Therefore, dissolving the rubber from around the agglomerates and redispersing them in a single plane so that they might be viewed with the electron microscope, appeared to offer the simplest method of evaluating breakdown.

The technique used in the preparation of the electron microscope specimens was as follows:

1. One per cent solutions of the compounds to be examined were prepared by mechanically shaking a weighed portion of the compound in the proper volume of heptane. Immediate and continued shaking is essential until all of the compound is dissolved because, if the undissolved compound is allowed to stand quietly in the heptane, swelling occurs which markedly increases the amount of agglomerate breakdown. If, on the other hand, the sample is shaken, the rubber dissolves at a more rapid rate than the heptane can diffuse into the rubber causing swelling.

FIG. 2—Appearance of dilute suspensions of the five compounds in petroleum naphtha after standing for three days.

2. A glass microscope slide is dipped about ⅔ of its length into a 0.1% Formvar (polyvinyl formal resin) in ethylene chloride solution and allowed to dry in a vertical position.

3. The Formvar-coated slide is next dipped to about ½ its length in the freshly shaken heptane solution of the compound. Again it is allowed to dry in a vertical position.

4. The sharp edges of the slide are scraped with the side of a needle in order to cut through the rubber and Formvar films, and then the double film is floated off on water. A portion of the floating film is mounted on a specimen screen in the usual manner.

The proper interpretation of micrographs of specimens prepared by the above technique must be compatible with the limitations of that technique. For instance, the amount of carbon black in any one field has no significance. The only useful information that can be derived from these micrographs is particle and agglomerate size. The formation of a rubber film simultaneously with the evaporation of the heptane has the advantage of keeping the carbon particles and agglomerates in a well dispersed condition. A minor amount of flocculation does occur, but it is possible to differentiate between a floc and a bonded agglomerate. The individual particles in a floc are quite distinct and are obviously in the same plane, while quite the opposite is true of the bonded agglomerates. The particles in the latter are chained in three dimensions causing them to mask one another. These agglomerates generally appear as dark irregular masses with little or no detail appearing except at the edges, as seen in Figures 3 and 4.

The preparation of carbon black-Butyl dispersions by the technique of varying mill nip openings has been carried out on a number of occasions. Characteristic electron micrographs of such dispersions are shown in Figures 3 and 4. The correlation between agglomerate size and mill setting is quite apparent. In the best dispersions discrete particles of the SRF black are discernible and measurements indicate that they are .06 to .10 microns in diameter. In coarser dispersions, large clumps or aggregates are seen with diameters as great as 5 or 6 microns. Such clusters contain 100,000 or 200,000 individual particles. Their presence may result in "starvation of reinforcement" and has a profound effect upon opacity of dilute solutions.

A statistical analysis has been made on the agglomerate size distributions of a series of five dispersions. These data are shown on the bar graphs in Figure 5. The data were obtained by counting and measuring between 200 and 300 agglomerates on suitable electron-

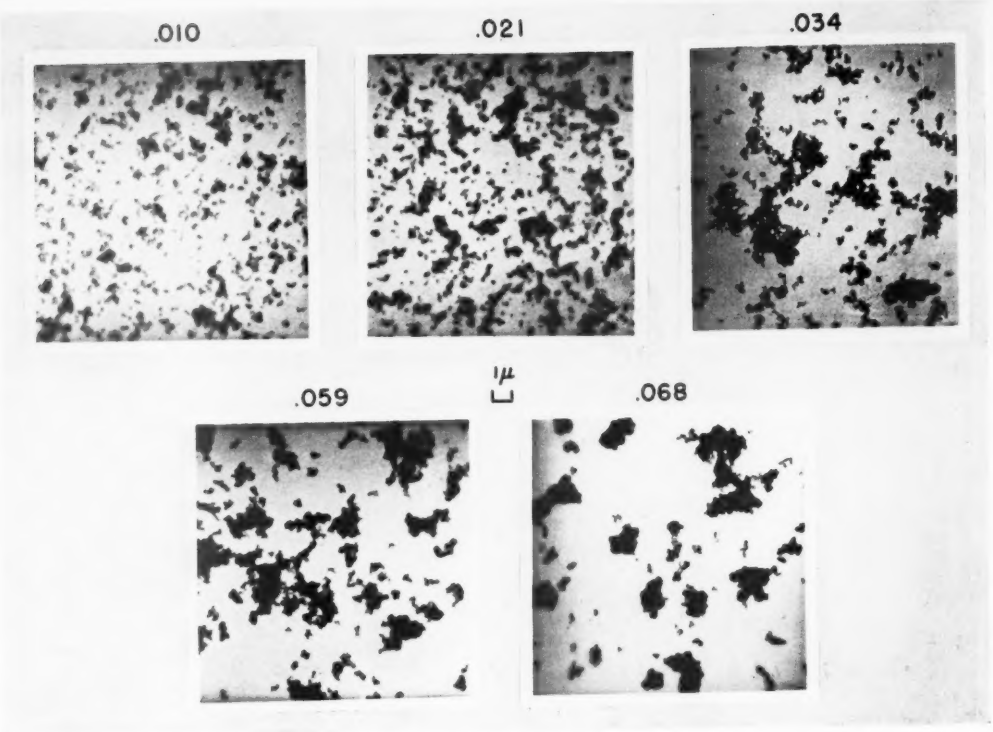

FIG. 3—Electronmicrographs of Butyl-carbon black dispersions, December, 1949.

micrograph prints. The actual values are shown in Table I.

Several important facts may be noted from these data. By far the largest occurrence of 0.0-0.1μ particles is in the .010-in. milled stock and the frequency of these smallest particles falls off sharply as the mill opening is increased. Likewise, the very largest clumps occur only in compounds prepared on the more open mills. There are no 0-0.1μ particles in the .070-in. gauge stock. The frequency in the 0.1-0.3μ class is remarkably uniform for all stocks. In the next larger group, 0.3-0.5μ, a definite discontinuity in the frequency occurs with the No. 4 stock which was mixed on a .050-in. mill. Further reference will be made to this point.

The electron microscope has thus provided excellent confirmation of the expectation that large differences in

TABLE I—AGGLOMERATE SIZE DISTRIBUTION

Stock	1		2		3		4		5	
GR-I-15	50		100		200		300		400	
SRF Black	25		50		100		150		200	
Mill Setting	.010"		.020"		.035"		.050"		.070"	
Time on Mill	4 Min.		3		4		4		5	
No. Counted	271		242		239		255		203	
Aver. Size (Microns)	0.17		0.26		0.35		0.39		0.46	
Distribution	No.	%	No.	%	No.	%	No.	%	No.	%
0-0.1μ	126	46.5	54	22.3	21	8.8	16	6.3	0	0
0.1-0.3μ	112	41.3	113	46.7	112	46.9	122	47.8	82	40.4
0.3-0.5μ	23	8.5	54	22.3	67	28.0	67	26.3	83	40.9
0.5-1.0μ	10	3.7	20	8.3	31	13.0	41	16.1	31	15.3
1.0-1.5μ	—	—	1	0.4	7	2.9	6	2.4	1	0.5
1.5-2.0μ	—	—	—	—	1	0.4	1	0.4	2	1.0
2.0-3.0μ	—	—	—	—	—	—	1	0.4	2	1.0
3.0-4.0μ	—	—	—	—	—	—	1	0.4	0	0
4.0-5.0μ	—	—	—	—	—	—	—	—	0	0
5.0-6.0μ	—	—	—	—	—	—	—	—	2	1.0

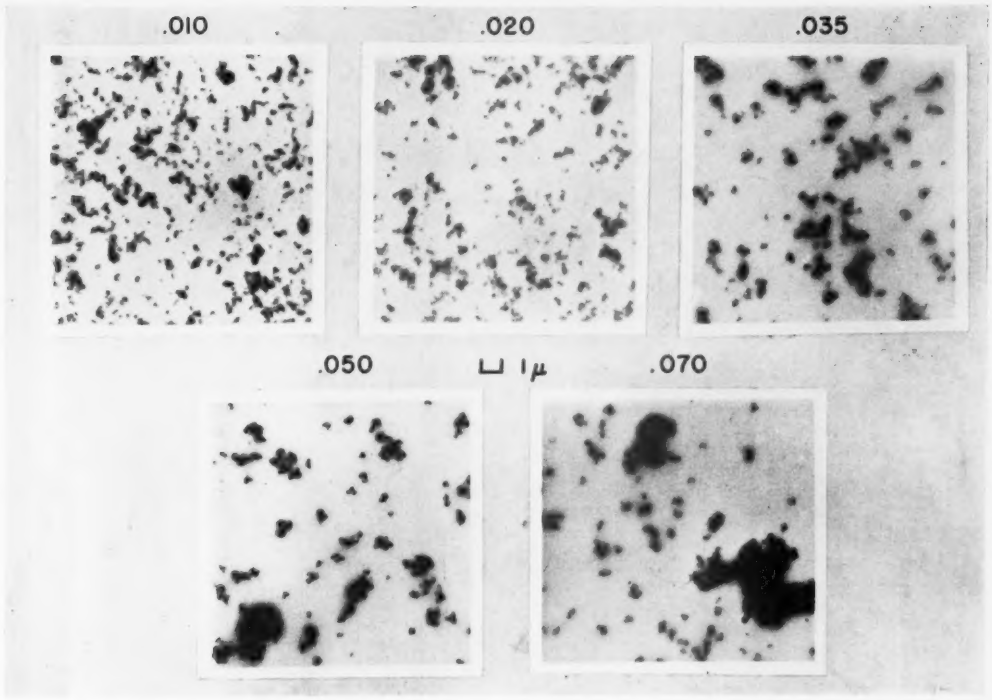

FIG. 1—Electronmicrographs of Butyl-carbon black dispersions, December, 1950.

the degree of dispersion exist in the five compounds under examination. It remains to be demonstrated that these differences result in significant differences in the physical properties of such compositions, differences which might correlate with important processing variables in the commercial utilization of such compositions.

Parallel Plate Plastometer Studies: To measure the physical properties of these Butyl black compositions in the unvulcanized state, use was made of the parallel plate plastometer, an instrument which measures the viscous and elastic behavior of polymers in fundamental units. It was selected as a means of measuring the physical properties of the unvulcanized compounds because of its convenience, availability, simplicity of operation and sensitivity. This instrument was described by Dienes and Klemm *(3)*. The instrument is similar to the commonly used Williams plastometer but is quite superior in these respects: (1) Greater freedom from frictional effects; (2) Better temperature control; (3) Greater latitude in the range of applied load. Measurements are made of the deformation versus time behavior of polymer samples under compression, and the data are treated in the light of Stefan's analytical development of fluid flow between parallel plates. Stefan has shown that, in cases where a viscous fluid does not completely fill the space between the plates, a material exhibiting Newtonian behavior should give a linear relation between the inverse fourth power of the plate separation, h, and the time of deformation, t. The final result can be written:

$$1/h^4 = 8\pi F\, t/3\eta\, V^2 + C$$

where h = distance between plates
F = applied force
V = volume of specimen
η = viscosity coefficient
t = time
and C is an integration constant.

Dienes and Klemm showed that for certain polymers, after an initial time interval, the plot of $1/h^4$ against t becomes linear in accordance with the above equation, and the dependence on the applied force is likewise in agreement. In other words, after an initial period in which elastic deformation is predominant, the flow of the polymer is simply viscous and follows Newtonian behavior. A typical flow curve is shown in Figure 6, the method of calculation also being indicated.

Viscosity data were obtained on two sets of carbon black-Butyl dispersions prepared and tested about a year apart. Data for both sets of stocks are shown in Table II. Included in these data are values for unpigmented polymer both before and after milling for at least seven minutes on a cold, tight mill. The reduction in viscosity during such an operation is negligible, and it may be assumed that the large differences in viscosity indicated for the carbon black loaded compounds are actually due to differences in the degree of dispersion.

One of the interesting facts to be pointed out here is that the poorest dispersion has the highest viscosity and the best dispersion has the lowest viscosity. This is consistent with commercial experience in remilling of Butyl stocks where the additional working lowers the Mooney viscosity more than can be expected as a result of poly-

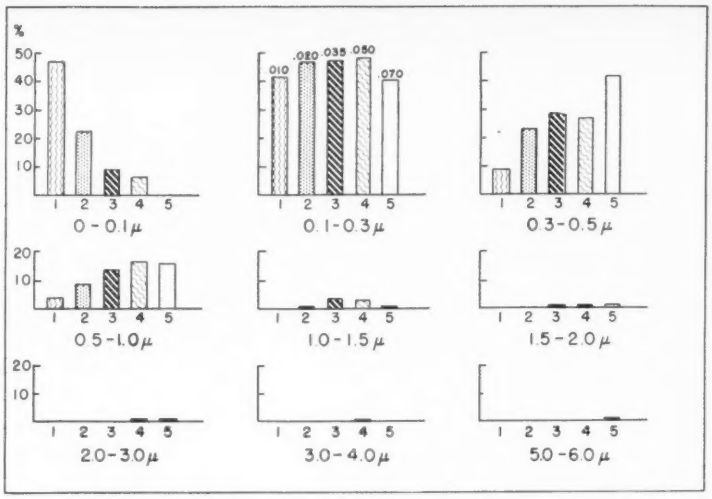

FIG. 5—Agglomerate size distribution of Butyl-carbon black dispersion. Data are based on a statistical analysis of the electron-micrographs shown in Figure 4.

mer breakdown alone. It is also consistent with current theoretical work by Guth *(4)*, and other investigators, who have found a "shape factor" to be of importance in calculating viscosities of carbon black-polymer systems.

It is also interesting to point out the reproducibility of such viscosity determinations. In most cases these values check quite closely for stocks prepared in similar manner some time apart. There is very good agreement among several determinations on one sample. These data indicate that this method of viscosity determination is quite accurate and reproducible.

An apparent anomaly occurred in the case of the No. 4 stock mixed in December, 1950, on a .050-in. gauge mill. The viscosity data appeared to be out of line with the general trend. It will be noted that the previous mixing of this 450 gram batch was done on a considerably wider mill, .059-in. nip opening. Upon examination, it turns out that this is undoubtedly a significant difference in the milling conditions. Not only will more grinding take place between the rolls but a substantially larger bank of stock is present in which additional fracturing of the carbon black can take place because of the deformation and recovery of the polymer as it is worked on the mill.

As pointed out earlier in the discussion of agglomerate size distributions, there is a discontinuity in the frequency of occurrence of 0.3-0.5μ particles for the No. 4 stock (.050-in. mill mix). This condition is consistent with the viscosity relationships.

The correlation of three different properties of Butyl-carbon black systems is given in Table III. The light transmission data were obtained with a Diller Colorimeter using suspensions containing .0068% solids. These values appear to be quite consistent with viscosity data as well as with agglomerate size distribution (Figure 5). Comparative data are also shown for two pure gum polymers—GR-I-15 and GR-I-70. The Mooney viscosity of these two polymers varies approximately 35 points when tested at 212° F. The difference between the two extremes of carbon black dispersion appears to be of the same order of magnitude.

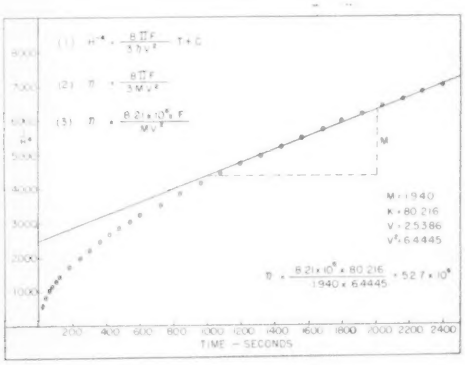

FIG. 6—Calculation of the viscosity of a polymer-pigment system, determined at 65° C., by means of the parallel plate plastometer. Dienes and Klemm have shown that, under certain conditions, Stefan's equation (1) for fluid flow between parallel plates is applicable to polymeric systems. The equation may then be expressed as in (3) and the viscosity calculated therefrom.

Discussion

It has been well established in commercial practice that the processing characteristics of a Butyl compound are improved as the dispersion of carbon black is improved. By this is meant that the extruding, forming and splicing operations are performed more easily and with fewer defects. A finer dispersion gives a more homogeneous composition which is relatively free of porosity, and which can be stretched and shaped more uniformly. Poor dispersions tend to give rough, uneven surfaces which are more easily deformed, developing localized thin spots. It is to be expected that a firm, homogeneous stock will be easier to splice than a non-uniform material of greater viscosity.

It also seems reasonable to expect that relatively large, irregular agglomerates would occlude air, gases or moisture more readily than a fine divided black pigment. If this is true, it is quite easy to understand why poorly dispersed carbon black stocks would frequently become porous upon extrusion. The occluded gases or moisture would expand during such an operation (usually carried out between 200° and 275° F.), forming a cellular or spongy structure.

It is even more apparent that large agglomerates, which are more loosely held by the polymer throughout which they are distributed, will settle out of solution quite readily. Thus it may be expected that cements made of poorly dispersed stocks will settle out and possess low adhesive strength.

In connection with the data and discussion presented above, it is interesting to note two papers, relating to dispersion of carbon black in rubber, which have recently been published. "Electrical Resistivity of Various Carbon Blacks in Natural, GR-S, Cold and Butyl Rubbers"*(7)* is discussed by Messrs. Sperberg, Popp and Biard in the August, 1950, issue of RUBBER AGE. In studying the conductivity of rubber stocks they found that "Butyl rubber is markedly superior to the other rubbers in contributing to excellent conductivity in black loaded compound, but is similar to the other rubbers in gum stocks. The trend in results is probably due to varying black dispersion in each of the rubbers. Since Butyl rubber is quite thermoplastic, less grinding action is exerted by this rubber than by the other rubbers and hence the black dispersion is poorer." Poor dispersion would account for good electrical conductivity.

The authors conclude "that the degree of milling of rubber-carbon black mixes has a major effect upon electrical resistivity of intermediate and large particle size blacks but has a relatively negligible effect upon fine particle size furnace and channel blacks. . . . Butyl rubber imparts excellent conductivity characteristics when reinforced with MAF black which should contribute to lower static charge accumulation on vehicles equipped with Butyl rubber inner tubes."

An investigation by Dannenberg, Jordan and Stokes was reported in *India Rubber World* for September, 1950, under the title "Effect of Mechanical Aggregation on the Dispersion Characteristics of Carbon Black"*(2)*. In this work, the authors reach similar conclusions regarding the dispersion of carbon black in Butyl. Using light transmission and electrical conductivity measurements they concluded "that the main factor responsible for the dispersion of carbon blacks is the nerve or elastic property of the medium which causes the disintegration of the carbon aggregates by the continual processes of deformation and elastic recovery or swelling of the raw stock during mixing and milling." In an interesting series of experiments they demonstrated that the dispersion of carbon black in Butyl can be markedly improved by the familiar Polyac reaction. Heat treatment of Butyl with Polyac, a cross-linking agent, for five minutes in a Banbury at 300 to 330° F. increases the toughness and "nerve" of this polymer. This increased "nerve" greatly improved carbon black dispersion. It was also shown that mere increase in viscosity, alone, is insufficient to influence dispersion.

In the present work, the authors have demonstrated that the degree of black dispersion in Butyl can also be altered by simple mechanical changes in the milling or mixing conditions. A new technique for measuring such differences by use of the electron microscope has been described. Such results correlate well with simple light transmission measurements. It is suggested that differences in dispersion have an important relationship to processing characteristics. Finally, the measurement of physical properties of unvulcanized carbon black systems has been accomplished by means of the parallel plate plastometer. The results obtained on this instrument are in good agreement with electron micrograph and light transmission observations. It is suggested that such techniques provide valuable tools for research in the field of pigment reinforcement of elastomeric materials.

TABLE II—VISCOSITY MEASUREMENTS OF CARBON BLACK DISPERSIONS

(50 Parts SRF in GR-I-15)

			1949		1950	
			Mill Setting	Viscosity $\eta(\times 10^{-6})$	Mill Setting	Viscosity $\eta(\times 10^{-6})$
Pure Gum (before milling)			——	18.5	——	20.3
				19.6		20.5
						21.8
Pure Gum (after milling)			.010	18.7	.010	18.7
				18.9		19.3
						19.8
CPTI	1	75 Grams	.010	46.3	.010	38.5
				48.6		40.6
	2	150 Grams	.021	46.1	.020	47.0
				50.6		48.2
						48.6
	3	300 Grams	.034	51.6	.035	54.6
				55.6		54.7
	4	450 Grams	.059	59.8	.050	50.4
				65.4		51.2
						52.2
	5	600 Grams	.068	69.1	.070	67.2
				71.7		71.1

TABLE III—CARBON BLACK DISPERSIONS

(50 Parts SRF in GR-I-15)

Mill Setting (Inches)	% Light Transmission (.0068% Sol'n.)	Average Agglomerate (Microns)	Viscosity ($\times 10^{-6}$ poises)
.010	20	0.17	39.6
.020	25	0.26	47.9
.035	57	0.35	54.6
.050	53	0.39	51.3
.070	60	0.46	69.2
GR-I-15 (Not Milled)			20.9
GR-I-15 (Milled 7', .010" Setting)			19.2
GR-I-70 (Not Milled)			54.5

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How to Get More Out of a Plant Power System with Synchronous Motors

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IN these days of rapidly expanding production, with the consequent up-swing in the installation of plant production machinery, many plant engineers are concerned about increasing the load on power systems that are already loaded almost to capacity. Others are contemplating the addition of new power systems where existing systems obviously cannot handle an expanding load.

In either case, high plant power factors are of prime importance, because the load which any power system will carry is proportional to the plant power factor, which is expressed as KW load divided by the KVA load. The efficiency of the whole plant power system increases as the power factor approaches unity. A higher power factor may make it possible to safely increase the hp load on an existing system. It can also mean less investment in transformers, feeder lines, and voltage regulating devices where a new system is required.

Good operating conditions require high power factors, too. Poor power factor often results in voltage drops which increase the slip of induction motors to the point where production is adversely affected. If the voltage drops more than 10 per cent below normal, it is quite possible for induction motors to become overheated or stall. And high power system losses, poor plant lighting conditions, high power bills, and increased maintenance of the power supply commonly accompany poor power factor.

In most power systems, poor power-factor is caused by excessive demands for magnetizing current (reactive kva) by induction motors at part loads, transformers, electric furnaces, electric welders, and other inductive equipment. This magnetizing current although necessary does no useful work, of course, and limits the power which a system can carry.

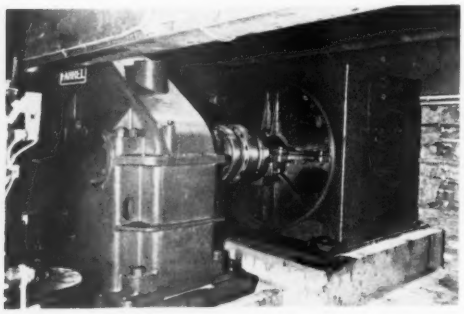

FIG. 1—G-E enclosed synchronous motor driving a Banbury mixer.

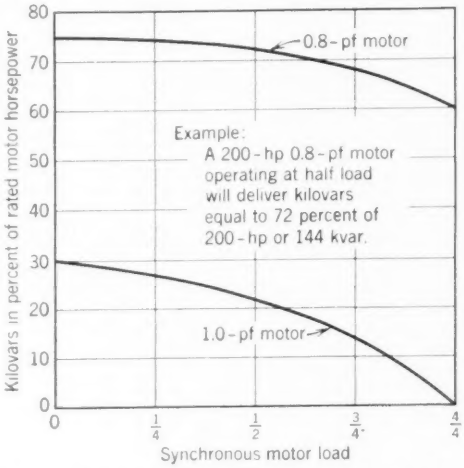

FIG. 2—Curves showing approximate kilovars supplied by synchronous motors.

When a new motor drive (75 hp or larger) is needed in a plant, the installation of a synchronous motor can economically improve plant power factor. This is of importance in the rubber industry where synchronous motors are often used for driving mills and other plant equipment because of the several unique advantages they offer.

For example, the frequent use of synchronous motors on rubber mills is brought about because they can utilize dynamic braking, which is not possible with other a-c motors. Even with a complete loss of a-c power, they will brake a rubber mill to a rapid, smooth stop by generating power that is dissipated into resistors. Stopping times as low as one second are frequently achieved without the possibility of damaging the mill, as may be the case with standard brakes or mechanical stopping devices.

Synchronous motors are well adapted to driving reciprocating air compressors in the rubber industry. The lower speeds required by reciprocating compressors usually make synchronous motors superior to other types of motors for this application (with regard to both initial investment and operating costs) in sizes above 75 hp where the motors are directly coupled to the compressor.

These motors are also used in driving Banbury mixers (Fig. 1) and plasticators in the rubber industry. What-

TABLE I—KW MULTIPLIERS FOR DETERMINING KILOVARS REQUIRED FOR POWER-FACTOR IMPROVEMENT.

Original Power Factor (cos θ_1)	Desired Improved Power Factor (cos θ_2)																				
	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.0
0.50	0.982	1.008	1.034	1.060	1.086	1.112	1.139	1.165	1.192	1.220	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.589	1.732
0.51	0.937	0.962	0.989	1.015	1.041	1.067	1.094	1.120	1.147	1.175	1.203	1.231	1.261	1.292	1.324	1.358	1.395	1.436	1.484	1.544	1.687
0.52	0.893	0.919	0.945	0.971	0.997	1.023	1.050	1.076	1.103	1.131	1.159	1.187	1.217	1.248	1.280	1.314	1.351	1.392	1.440	1.500	1.643
0.53	0.850	0.876	0.902	0.928	0.954	0.980	1.007	1.033	1.060	1.088	1.116	1.144	1.174	1.205	1.237	1.271	1.308	1.349	1.397	1.457	1.600
0.54	0.809	0.835	0.861	0.887	0.913	0.939	0.966	0.992	1.019	1.047	1.075	1.103	1.133	1.164	1.196	1.230	1.267	1.308	1.356	1.416	1.559
0.55	0.769	0.795	0.821	0.847	0.873	0.899	0.926	0.952	0.979	1.007	1.035	1.063	1.093	1.124	1.156	1.190	1.227	1.268	1.316	1.376	1.519
0.56	0.730	0.756	0.782	0.808	0.834	0.860	0.887	0.913	0.940	0.968	0.996	1.024	1.054	1.085	1.117	1.151	1.188	1.229	1.277	1.337	1.480
0.57	0.692	0.718	0.744	0.770	0.796	0.822	0.849	0.875	0.902	0.930	0.958	0.986	1.016	1.047	1.079	1.113	1.150	1.191	1.239	1.299	1.442
0.58	0.655	0.681	0.707	0.733	0.759	0.785	0.812	0.838	0.865	0.893	0.921	0.949	0.979	1.010	1.042	1.076	1.113	1.154	1.202	1.262	1.405
0.59	0.619	0.645	0.671	0.697	0.723	0.749	0.776	0.802	0.829	0.857	0.885	0.913	0.943	0.974	1.006	1.040	1.077	1.118	1.166	1.226	1.369
0.60	0.583	0.609	0.635	0.661	0.687	0.713	0.740	0.766	0.793	0.821	0.849	0.877	0.907	0.938	0.970	1.004	1.041	1.082	1.130	1.190	1.333
0.61	0.549	0.575	0.601	0.627	0.653	0.679	0.706	0.732	0.759	0.787	0.815	0.843	0.873	0.904	0.936	0.970	1.007	1.048	1.096	1.156	1.299
0.62	0.516	0.542	0.568	0.594	0.620	0.646	0.673	0.699	0.726	0.754	0.782	0.810	0.840	0.871	0.903	0.937	0.974	1.015	1.063	1.123	1.266
0.63	0.483	0.509	0.535	0.561	0.587	0.613	0.640	0.666	0.693	0.721	0.749	0.777	0.807	0.838	0.870	0.904	0.941	0.982	1.030	1.090	1.233
0.64	0.451	0.474	0.503	0.529	0.555	0.581	0.608	0.634	0.661	0.689	0.717	0.745	0.775	0.806	0.838	0.872	0.909	0.950	0.998	1.058	1.201
0.65	0.419	0.445	0.471	0.497	0.523	0.549	0.576	0.602	0.629	0.657	0.685	0.713	0.743	0.774	0.806	0.840	0.877	0.918	0.966	1.026	1.169
0.66	0.388	0.414	0.440	0.466	0.492	0.518	0.545	0.571	0.598	0.626	0.654	0.682	0.712	0.743	0.775	0.809	0.846	0.887	0.935	0.995	1.138
0.67	0.358	0.384	0.410	0.436	0.462	0.488	0.515	0.541	0.568	0.596	0.624	0.652	0.682	0.713	0.745	0.779	0.816	0.857	0.905	0.965	1.108
0.68	0.328	0.354	0.380	0.406	0.432	0.458	0.485	0.511	0.538	0.566	0.594	0.622	0.652	0.683	0.715	0.749	0.786	0.827	0.875	0.935	1.078
0.69	0.299	0.325	0.351	0.377	0.403	0.429	0.456	0.482	0.509	0.537	0.565	0.593	0.623	0.654	0.686	0.720	0.757	0.798	0.846	0.906	1.049
0.70	0.270	0.296	0.322	0.348	0.374	0.400	0.427	0.453	0.480	0.508	0.536	0.564	0.594	0.625	0.657	0.691	0.728	0.769	0.817	0.877	1.020
0.71	0.242	0.268	0.294	0.320	0.346	0.372	0.399	0.425	0.452	0.480	0.508	0.536	0.566	0.597	0.629	0.663	0.700	0.741	0.789	0.849	0.992
0.72	0.214	0.240	0.266	0.292	0.318	0.344	0.371	0.397	0.424	0.452	0.480	0.508	0.538	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.73	0.186	0.212	0.238	0.264	0.290	0.316	0.343	0.369	0.396	0.424	0.452	0.480	0.510	0.541	0.573	0.607	0.644	0.685	0.733	0.793	0.936
0.74	0.159	0.185	0.211	0.237	0.263	0.289	0.316	0.342	0.369	0.397	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.75	0.132	0.158	0.184	0.210	0.236	0.262	0.289	0.315	0.342	0.370	0.398	0.426	0.456	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.76	0.105	0.131	0.157	0.183	0.209	0.235	0.262	0.288	0.315	0.343	0.371	0.399	0.429	0.460	0.492	0.526	0.563	0.604	0.652	0.712	0.855
0.77	0.079	0.105	0.131	0.157	0.183	0.209	0.236	0.262	0.289	0.317	0.345	0.373	0.403	0.434	0.466	0.500	0.537	0.578	0.626	0.686	0.829
0.78	0.052	0.078	0.104	0.130	0.156	0.182	0.209	0.235	0.262	0.290	0.318	0.346	0.376	0.407	0.439	0.473	0.510	0.551	0.599	0.659	0.802
0.79	0.026	0.052	0.078	0.104	0.130	0.156	0.183	0.209	0.236	0.264	0.292	0.320	0.350	0.381	0.413	0.447	0.484	0.525	0.573	0.633	0.776
0.80	0.000	0.026	0.052	0.078	0.104	0.130	0.157	0.183	0.210	0.238	0.266	0.294	0.324	0.355	0.387	0.421	0.458	0.499	0.547	0.609	0.750
0.81		0.000	0.026	0.052	0.078	0.104	0.131	0.157	0.184	0.212	0.240	0.268	0.298	0.329	0.361	0.395	0.432	0.473	0.521	0.581	0.724
0.82			0.000	0.026	0.052	0.078	0.105	0.131	0.158	0.186	0.214	0.242	0.272	0.303	0.335	0.369	0.406	0.447	0.495	0.555	0.698
0.83				0.000	0.026	0.052	0.079	0.105	0.132	0.160	0.188	0.216	0.246	0.277	0.309	0.343	0.380	0.421	0.469	0.529	0.672
0.84					0.000	0.026	0.053	0.079	0.106	0.134	0.162	0.190	0.220	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646
0.85						0.000	0.027	0.053	0.080	0.108	0.136	0.164	0.194	0.225	0.257	0.291	0.328	0.369	0.417	0.477	0.620
0.86							0.000	0.026	0.053	0.081	0.109	0.137	0.167	0.198	0.230	0.264	0.301	0.342	0.390	0.450	0.593
0.87								0.000	0.027	0.055	0.083	0.111	0.141	0.172	0.204	0.238	0.275	0.316	0.364	0.424	0.567
0.88									0.000	0.028	0.056	0.084	0.114	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540
0.89										0.000	0.028	0.056	0.086	0.117	0.149	0.183	0.220	0.261	0.309	0.369	0.512
0.90											0.000	0.028	0.058	0.089	0.121	0.155	0.192	0.233	0.281	0.341	0.484
0.91												0.000	0.030	0.061	0.093	0.127	0.164	0.205	0.253	0.313	0.456
0.92													0.000	0.031	0.063	0.097	0.134	0.175	0.223	0.283	0.426
0.93														0.000	0.032	0.066	0.103	0.144	0.192	0.252	0.395
0.94															0.000	0.034	0.071	0.112	0.160	0.220	0.363
0.95																0.000	0.037	0.079	0.126	0.186	0.329
0.96																	0.000	0.041	0.089	0.149	0.292
0.97																		0.000	0.048	0.108	0.251
0.98																			0.000	0.060	0.203
0.99																				0.000	0.143
																					0.000

ever the application, totally-enclosed construction is recommended for all synchronous motors driving rubber processing equipment. This type of construction assures longer life and lower over-all operating costs by keeping motor windings and other internal parts clean.

With regard to improving plant power factor through the installation of a synchronous motor, a unity power factor synchronous motor (current in phase with the voltage) accomplishes this by adding to the kw load on a power system without increasing the reactive kva load, since it needs no magnetizing current to operate when normally excited at full load. In other words, it brings the ratio

$$\frac{\text{kw}}{\text{kva}}$$

closer to 1. For example, if a 1000-hp unity power factor synchronous motor is added to a 1000-hp plant load having a power factor of .80, the new load of 2000 hp would have a power factor of .935.

A leading power factor synchronous motor (current leading the voltage) improves plant power factor because it acts as a kilovar generator, and can supply fairly large amounts of kilovars to a power system while performing its usual driving duties.

The ability of either unit power factor or 0.8 power factor synchronous motors to improve power factor is a function of load and excitation. Decreasing the mechanical load without changing the field excitation increases the reactive kva output of the motor. Fig. 2 shows the reactive kva that two typical synchronous motors will deliver under various load conditions with normal excitation. It is seldom economical to operate a synchronous motor at part load in order to gain greater power-factor improvement and the motor should never be over-excited for this purpose, as this practice can lead to serious overheating.

TABLE II—LEADING REACTIVE KVA PER KW INPUT FOR SYNCHRONOUS MOTORS

Pf.	Kvar	Pf.	Kvar
1.00	.000	.74	.909
.99	.142	.73	.936
.98	.203	.72	.964
.97	.251	.71	.992
.96	.292	.70	1.020
.95	.329	.69	1.049
.94	.363	.68	1.078
.93	.395	.67	1.108
.92	.426	.66	1.138
.91	.456	.65	1.169
.90	.482	.64	1.201
.89	.512	.63	1.233
.88	.540	.62	1.266
.87	.567	.61	1.299
.86	.593	.60	1.333
.85	.620	.59	1.368
.84	.646	.58	1.405
.83	.672	.57	1.442
.82	.698	.56	1.479
.81	.724	.55	1.508
.80	.750	.54	1.559
.79	.776	.53	1.600
.78	.802	.52	1.643
.77	.829	.51	1.687
.76	.855	.50	1.732

Another desirable characteristic of the synchronous motor with regard to its effect on the plant power supply is its tendency to stabilize the voltage. Under conditions of high voltage, the reactive kva furnished by a synchronous motor decreases, and under conditions of low voltage within reasonable limits, it increases. The motor, therefore, has a tendency to hold a constant voltage in the power supply.

Furthermore, synchronous motors usually have a higher full-load efficiency than any other type of motor, and produce a greater amount of work per dollar's worth of power consumed. Where loads are heavy and continuous, an advantage of from 0.5 to 3.0 percent in efficiency saves a considerable sum in operating expense, and leaves more power available for other plant equipment. At reduced loads, the difference becomes greater to a marked degree, for an efficiency of 75 percent at 5 percent load has been attained in a synchronous motor.

Whether or not a synchronous motor should be installed for power factor correction depends upon several factors. A careful study might reveal that the particular plant and application might lend themselves better to induction motors and capacitors under certain conditions. The total cost, total load, present power factor, and amount of power factor improvement desired all have a bearing on the type of apparatus best suited for improving the power factor. And the provisions made for obtaining a high power factor in a brand new plant are likely to be quite different from those feasible in an existing plant.

Table I is a tabulation of multipliers which may be used to determine the number of kilovars required to improve power factor by given degrees. Table II shows the kilovars generated by synchronous motors per kw input at various power factors. These tables may be used together to determine the approximate size of synchronous motor which would be needed to accomplish a required power-factor improvement.

For example, the data in Table I may be used as follows to determine kilovars required for power-factor improvement: Plant has input of 200 kw at a power factor of 80 percent. To find the reactive kva required to raise the plant power factor to a desired 95 percent, multiply the 200 kw by the factor found in the table under 95 percent opposite the original power factor of 80 percent, or 0.421. Kvar required, therefore, is 200 x 0.421 or 84.2 kvar.

To find the horsepower rating of 0.8 power factor synchronous motor required to furnish the 84.2 kvar determined as above, the data in Table II can be utilized, as follows: The table indicates that an 0.8 power factor synchronous motor furnishes 0.75 kvar per kw input. The 84.2 kvar required divided by 0.75 equals 112.3 kw. Converting this value to approximate horsepower (neglect motor efficiency and divide by .746), we see that a 150-hp motor at 0.8 power factor would be recommended.

Besides their ability to improve the efficiency of plant power systems, synchronous motors have other desirable characteristics which make them especially suitable for many kinds of large motor drives. Some of these are:

1. They may be obtained at very low speeds, thus eliminating or reducing the need for speed-reducing gears.

2. The construction of low-speed synchronous motors results in a saving in space along the shaft when the motor is to be overhung or built into the driven machine.

3. Split rotor construction is optional in low-speed types, which facilitates assembly on shaft of driven machines.

4. Low maintenance costs are the result of inherently simple construction which leaves all parts accessible.

5. In ratings where the hp is equal to or greater than the speed, they have a lower first cost, including control and exciter, than any other a-c motor with its control.

6. A wide range of torques is available to make possible starting under heavy loads.

7. Dynamic braking brings heavy loads to a smooth, quick stop.

8. Since they run at an exact rated speed, they insure a constant rate of production in constant-speed applications. This constant-speed feature is not affected by voltage changes.

9. They have an inherently large air gap, making field assembly and maintenance easy and economical.

The combined economic and operating advantages of synchronous motors make their consideration worthwhile where any plant requires a new large motor drive. In many instances the installation of synchronous motors is the most economical method of improving plant power factor when their ability to provide efficient mechanical power at the same time is considered.

Report on an Avoidable Accident

Tire Blows in Test Laboratory: A worker in the test lab was dismounting an 1100 x 20 truck tire from a K-type split rim and had failed to see that it was properly deflated. Two men were working together on the job, and it appears that each believed that the other had deflated the tire. During the dismounting job, the tire blew, causing the rim to fly off the tire and strike one of the workers on both his arms. He received compound fractures of both arms. Employees have been told many times of the importance of deflating tires before trying to dismantle them. In addition, it is also very important that where two men are working on the stripping job, each man know his job so that neither one depends on the other to do a single operation.

Mineral Nutrition of Hevea Brasiliensis

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THE production of Hevea latex is dependent on the capacity of the *Hevea brasiliensis* tree to grow rapidly to a tappable size and to attain a vigorous state of health. A considerable amount of work has been done on fertilizing rubber trees in the field to attain the desired stimulation but many of the results have been indefinite or conflicting with the results of other workers. The use of nitrogen has become common practice but the use of mineral fertilizers has been rather limited and of doubtful value.

This study was set up to determine the relative importance of calcium, magnesium, potassium, sulfur, phosphorus, iron, manganese, zinc and boron for growth and vigor of the rubber tree. The study also determined the optimum pH range. The nitrogen supply was not taken up here because it has been well established that nitrogen is an important fertilizer for rubber culture.

Earlier Work on Hevea Nutrition

Reference to early texts on rubber culture *(10)* reveals that a wide variety of fertilizers were being used prior to 1910. Two recommended formulae contained nitrogen, phosphate and potassium. The experimental evidence supporting the use of these fertilizers was very limited; some acceleration of growth had been reported over short periods. Grantham *(4)* reported a marked increase in rubber yield from nitrogen fertilizers and a retarding influence from application of superphosphate on white Sumatra soil. The Grantham experiments led to a marked increase in the use of nitrogenous fertilizers on rubber plantations.

More recent experimental evidence *(3)* has shown an economic advantage in the use of complete (NPK) fertilizers over nitrogen alone for rubber on some soils. This advantage increases as the period of treatment extends, a circumstance that appears to result from a general improvement in plantings on a balanced diet. The NPK formula is now in general use in Malaya for new plantings, although it is recognized that the soils vary considerably in their need for K and P. No study has been encountered where magnesium was added to a complete fertilizer mixture.

Some More Recent Reports

The Rubber Research Institute of Malaya *(5, 6, 8)* started some nutrient culture studies that were interrupted by the war. Their preliminary reports indicated that the rubber tree required nitrogen, phosphorus, potassium, magnesium and a mixture of minor elements for optimum growth. Lack of nitrogen, phosphate, minor elements and potassium appeared to have marked inhibiting effects. A recent report *(2)* discloses Hevea nutrition studies related to those reported here. Retardation of growth was noted from omission of nitrogen, phosphate, sulfur and magnesium. Only a slight effect was noted from elimination of potash, probably because the sand utilized had some available potash.

Note: This paper was presented at the 12th International Congress of Pure and Applied Chemistry, New York, N. Y., September 12, 1951.

Experimental Methods

At the outset of this experiment, inadequate work had been reported on the nutrition of the rubber tree to serve as a basis for selection of a nutrient solution approaching the optimum. The work carried out in Malaya *(5, 6)* did not employ pH control, nor was distilled water utilized for solution preparation. Some work had been done previously at this laboratory, with solutions very similar to those employed in Malaya, but the results were not expected trends in nutritional studies. It was decided that pH control and use of the best available grade of reagent chemicals in distilled water were absolutely essential.

The Hevea tree was known to be sensitive to alkaline conditions; for this reason it appeared particularly important to avoid nutrient solutions with nitrate as the sole source of nitrogen. Both nitrate and ammonium nitrogen were utilized in the solution finally adopted, with the ratios adjusted to hold the desired pH range. The control solution utilized gave excellent growth but it is still not established as the best that can be devised.

A pH value of 4.5 was selected for the bulk of the solutions. This was judged to meet the rubber trees' requirement of acid conditions. The completed study indicated that this pH value was about optimum. All solutions were checked regularly for pH before and after application to the plant. Original solutions were adjusted with NaOH or HCl to the desired level. The nitrate-ammonium ratio and high feed rates tended to keep the effluent solution very close to the incoming solution pH value.

A dilute solution, about ¼ atmosphere, was utilized because the normal habitat of the rubber tree is a very much leached tropical soil. A complete control solution was fed to 12 plants (2 groups of 6) and one group (6 plants) was fed a solution void of one major mineral element (K, Ca, Mg, P and S).

Solutions very low in one mineral element were also prepared, the mineral being present at 5% of the level selected for the complete control. This preliminary experiment was limited to severe depletion levels because the rubber tree was known to grow well on tropical soils that are characterized by low fertility.

Sodium salts were utilized for replacing Ca, Mg and K and chloride salts for replacing sulfate and phosphate.

A separate group of plants was fed a high calcium formula and another group a low calcium formula. The formulae are given in the section discussing calcium later in this report.

The relative importance of the minor elements was investigated by growth of plants on the following:

1. A solution without zinc.
2. A solution without boron.
3. A solution low in iron, a solution with a high Mn/Fe ratio actually being employed.
4. A solution low in Mn, the solution actually employed being of a high Fe/Mn ratio.

Fe, Mn and Zn were supplied as chlorides and boron was supplied as boric acid. One fourth of the iron was

TABLE I—COMPLETE CONTROL NUTRIENT SOLUTION

Reagent	Ml of M/2 Solution for 200 Liters	Molar Concentration
NH_4NO_3	350	.00088
$Ca(NO_3)_2$	400	.001
KH_2PO_4	160	.0004
KNO_3	340	.00085
$MgSO_4$	200	.0005

TABLE II—CONCENTRATION OF ELEMENTS IN SOLUTION (PPM)

	100% Level (Complete Control Level)	5% Level (Severe Depletion Level)
Ca	40.0	2.0
K	49.0	2.5
Mg	12.0	0.6
S	16.0	0.8
P	12.0	0.6
N	65.0	—
Fe	2.5	—
Mn	0.2	—
B	0.2	—
Zn	0.2	—

TABLE III—DISTRIBUTION OF ANALYSES FOR 56 MALAYAN SOILS

Analysis Grade	No. of Analyses in Grade				Approximate Pounds per Acre of Available Nutrients in Analysis Grade			
	Ca	Mg	K	P	Ca	Mg	K	P
None	54	15	26	—	——	——	——	——
Trace	2	36	28	5	100	3	50	4
Very very low	—	3	1	11	——	10	75	6
Very low	—	—	1	19	——	20	100	10
Low	—	1	—	19	——	30	——	25
Medium	—	1	—	2	——	50	——	50

TABLE IV—ANALYSES OF FIELD GROWN TREE

	% Ca	% Mg	% K	% P	% N
Leaf	1.26	0.37	0.92	0.15	2.50
Twig	1.39	0.09	1.06	0.14	1.07
Small Branch	0.60	0.06	0.33	0.041	0.41

TABLE V—TOTAL AIR DRY WEIGHTS

(Average Weights in Grams)

	Leaves	Petioles	Stems	Roots	Fallen Leaves*	Total
5% Mg	38.2	10.5	93.7	24.5	18.3	185.2
No Mg	24.7	4.8	67.1	22.7	14.6	133.9
5% Ca	199.1	53.0	286.7	61.4	9.6	609.8
No Ca	165.3	44.1	239.0	61.1	16.7	526.2
5% K	101.6	23.4	183.1	42.5	17.3	367.9
No K	25.7	3.7	58.2	18.1	3.4	109.1
5% P	64.6	15.5	113.3	51.4	23.7	268.5
No P	36.2	6.3	87.4	55.3	12.5	197.7
5% S	183.2	45.9	260.7	72.9	12.0	574.7
No S	41.3	8.0	72.0	40.1	7.2	168.6
Complete, pH 3.0	64.2	12.7	71.8	26.1	2.6	174.8
Complete, pH 3.5	115.9	31.1	149.6	37.9	8.7	343.2
Complete S, pH 4.5	193.3	48.3	272.1	67.5	27.9	609.1
Complete N, pH 4.5	178.0	51.4	274.8	66.8	11.2	582.2
Complete, pH 5.5	144.4	42.3	233.5	55.9	12.2	488.3
Complete, pH 6.5	118.1	27.7	173.3	30.8	7.5	257.4
Complete, pH 7.5	68.9	15.1	100.8	31.3	5.6	221.7
pH 6.5, Fe Sp.	152.4	38.2	166.6	44.1	11.3	412.6
High Fe	145.0	36.6	200.6	51.5	10.0	443.7
High Mn	128.1	31.3	157.9	40.1	13.0	370.4
No Zn	179.6	49.4	265.2	61.3	15.9	571.4
No B	171.8	43.7	272.5	66.0	12.7	566.7
Low Ca	170.9	37.2	212.4	63.6	16.1	500.2
High Ca	119.4	27.7	183.1	53.1	29.6	412.9

*Weights for fallen leaves are oven dry values; all other parts of plant uniformly dried to 94% total solids.

supplied as ferric iron and ¾ of the iron as ferrous iron. The dilute solutions applied to the plants were made up fresh every second or third day to limit precipitation of iron and manganese.

The effect of pH was studied by feeding groups of plants with solutions adjusted to pH 3, 3.5, 4.5 (the two regular control groups), 5.5, 6.5 and 7.5. The ratio of $+NH_4$ to $-NO_3$ was decreased from low pH groups to high pH groups. HCl was used for the initial adjustment of low pH groups and NaOH for the initial adjustment of high pH groups. Tables I and II give the formulae utilized.

Stock solutions of reagents were M/2 in concentration. These stock solutions were utilized to prepare concentrated nutrient solutions, 10 times the concentration of the final nutrient solutions, in 20 liter bottles. Two liters of concentrated solution were diluted to 20 liters as required. Iron was added directly to the final dilute solution.

Large quantities of nutrient solution had to be handled at our greenhouse to carry out this extensive experiment. All glassware holding solutions was painted with a black undercoat and a white finish coat. The black paint was particularly effective for reducing growth of algae. Excessive growth of algae develops quickly at the tropical conditions required for rubber trees. Plants were fed 500 ml. of solution per day at the start and about 3 liters per day at the end of the experiment. The feed rate was increased as the need arose. A continuous drip feeding system was used.

The seeds for this experiment were supplied by the United States Department of Agriculture and by the Plantations Division of the United States Rubber Company, and we are grateful for the help. The seeds were shipped in moss or in moist charcoal. The seeds were germinated in acid washed sand and transferred to acid washed sand in waxed pots. The seedlings were in a starved condition when nutrient solutions were applied. The most uniform population was taken and randomized in the experiment. The seeds were planted late in December, 1946, and put on experimental feeding on March 10, 1947. Harvesting was September 26, 1947.

The growth data are accumulated in Tables V and IX which summarize growth trends effectively. A number of deficiency symptoms appeared and these are discussed in the following sections. Figures 1, 2 and 3 illustrate the effects on size and nature of growth.

Potassium: Potassium elimination resulted in more complete retardation of growth than that of any other treatment. The plants without potassium grew well for about two months. Almost complete defoliation then occurred along with a chlorotic condition of the young leaves at the growing point. Two plants of the group without potassium died.

The 5% level of potassium (severe depletion level) was adequate for what appeared to be almost normal development; however, final weights show that the plants averaged only 61% of the control value. The control had 49 ppm potassium and the severe depletion sample 2.5 ppm. The rubber tree has shown remarkable ability to grow at a low potassium level. It is still probable, however, that many tropical soils have inadequate potassium for normal development of the tree. It appears that this situation can always be corrected by very small potassium applications.

Magnesium: Rubber trees have exhibited a relatively high magnesium need. A control group with 12 ppm Mg appeared to be adequately supplied but the 5% level group (0.6 ppm) showed severe deficiency symptoms. The leaves developed chlorotic areas between the veins

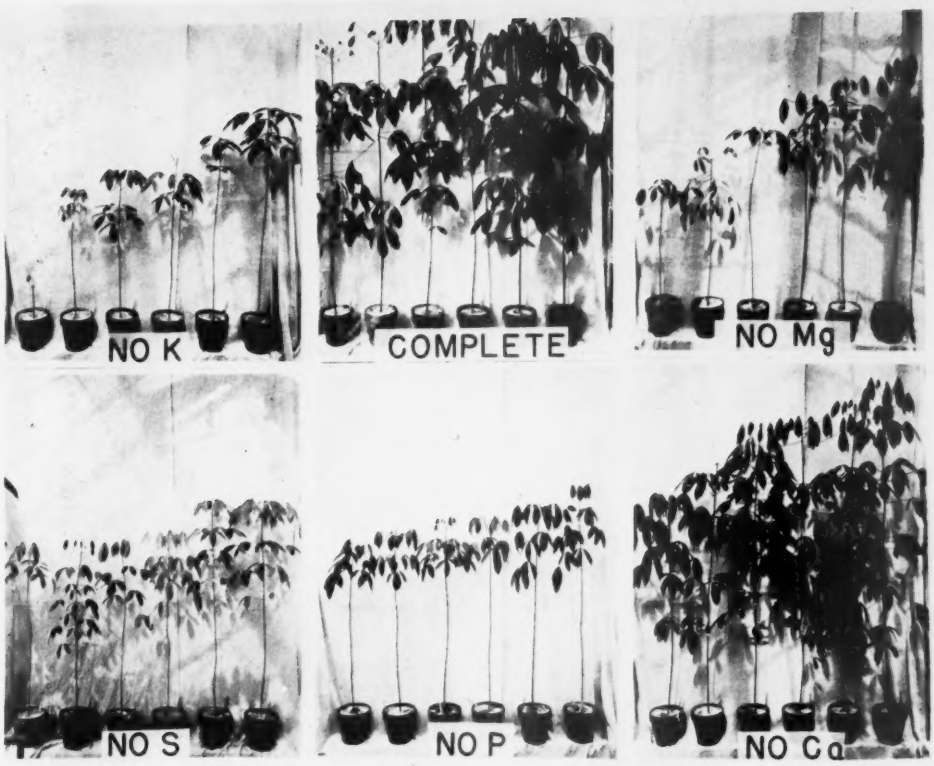

FIG. 1—Plants deprived of one major element. The effects of eliminating the major elements, one at a time, are shown.

in a characteristic pattern. New leaves were normal but old leaves were completely affected. The leaves abscissed prematurely leaving the plant partially defoliated. The trunks were abnormally slender. The plants without magnesium appeared to be about the same as those of the 5% level.

The observations above indicate that rubber trees may suffer extensively from magnesium deficiency and that moderate applications may be necessary for normal development. This element has been neglected and should be further investigated. Ten to forty pounds of MgO per acre, in the form of soluble salts, generally corrects magnesium deficiency.

The magnesium requirement may prove to be much less in the field than indicated by this experiment because of the normally low calcium and potassium supply in tropical soils. The principles which indicate this are expressed in the section on cation balance.

Calcium: Soil analyses indicate an extraordinarily low calcium level on the Malayan estates. This does not appear serious inasmuch as the rubber tree exhibited considerable ability to grow at extraordinarily low calcium levels. A very high calcium level (High Ca group) produced early defoliation and retarded development. The calcium level of the solution was raised to three times the control level and the Mg and K levels dropped to 25% and 35% of the control levels respectively. This represents what might happen where heavy calcium applications are made. The Mg content of the leaf dropped to the "No Mg" level under this treatment. Displacing reactions of this severity are not likely to occur in the field unless very heavy fertilizer applications are made. Excellent growth in the complete control groups indicated no harm from moderate calcium levels if the supply of other elements is adequate.

Calcium may be more important in the field where the iron and aluminum concentration is higher than in nutrient solutions or under conditions of compound deficiencies of K and Mg.

The High Ca group of plants and the Low Ca group are not entirely comparable to the other plants of the experiment. These plants were grown on complete solutions for a period. They were somewhat smaller than the regular complete group when selected. The High Ca and Low Ca groups are directly comparable to each other. Their per cent nutrient solution composition was, in comparison to complete control, as follows:

	Ca	Mg	K	N	P	S
Complete Control (pH 4.5)	100	100	100	100	100	100
High Ca (pH 4.5).....	300	25	35	100	100	100
Low Ca (pH 4.5).....	50	150	200	100	100	100

FIG. 2—Plants on solutions severely deficient in one major element. Severe depletion effects are shown. Each deficient group had only 5% of the control level supply of the deficient element but a normal supply of the remaining elements.

The low calcium sample plants did not lose their leaves like the high calcium sample plants. The low calcium group appeared in a much more vigorous condition than the high calcium group as the experiment ended.

Phosphate: Severe depletion or complete elimination of phosphate has retarded development. The plants had a dark green color but new leaves remained small and did not develop their full green color for a considerable period of time. Retardation did not appear as severe as that caused by low magnesium, by elimination of potassium, or by elimination of sulfur. Differences between the no P and 5% level were not marked; this indicates a moderate phosphate demand. The complete level had 12 ppm P and the 5% level had 0.6 ppm P.

High phosphate levels interfere with iron metabolism in an iron-sensitive plant; for this reason, high levels were avoided in these studies. Depletion of phosphate is accompanied by low nitrogen content.

Sulfate: Complete elimination of sulfur as sulfate brought about a general chlorotic condition and marked retardation of development. The 5% level (0.8 ppm S) appeared adequate for normal development. Sulfur deficiency may occur in some very depleted tropical soils but can be corrected by very small applications of sulfur-bearing fertilizers. Low sulfur plants have a low nitrogen content.

pH Variation: The rubber tree appears to have an optimum pH level at about 4.5 to 5.5. It appears to suffer severely from lack of iron at high pH levels. Plants grown at high pH levels show almost the same symptoms as plants grown at a high Mn/Fe ratio. Iron solution sprays on the foliage largely reduce the chlorotic condition developed on high pH solutions. It is difficult to get iron solutions to penetrate the waxy leaf surface.

Plants at the highest pH level were stunted, defoliated and markedly chlorotic. New leaves were small and almost white. Plants at the lowest pH level were severely stunted but had leaves of deep green color.

Minor Elements: The high iron solution revealed no definite abnormal symptoms throughout the experiment although growth was not quite as great as for the complete control. The high iron plants had 10 ppm of Fe and 0.02 ppm of Mn and the complete control group had 2.5 ppm of Fe and 0.2 ppm of Mn.

The high manganese group of plants, fed 5.0 ppm of Mn and 0.5 ppm of Fe, suffered severe chlorosis.

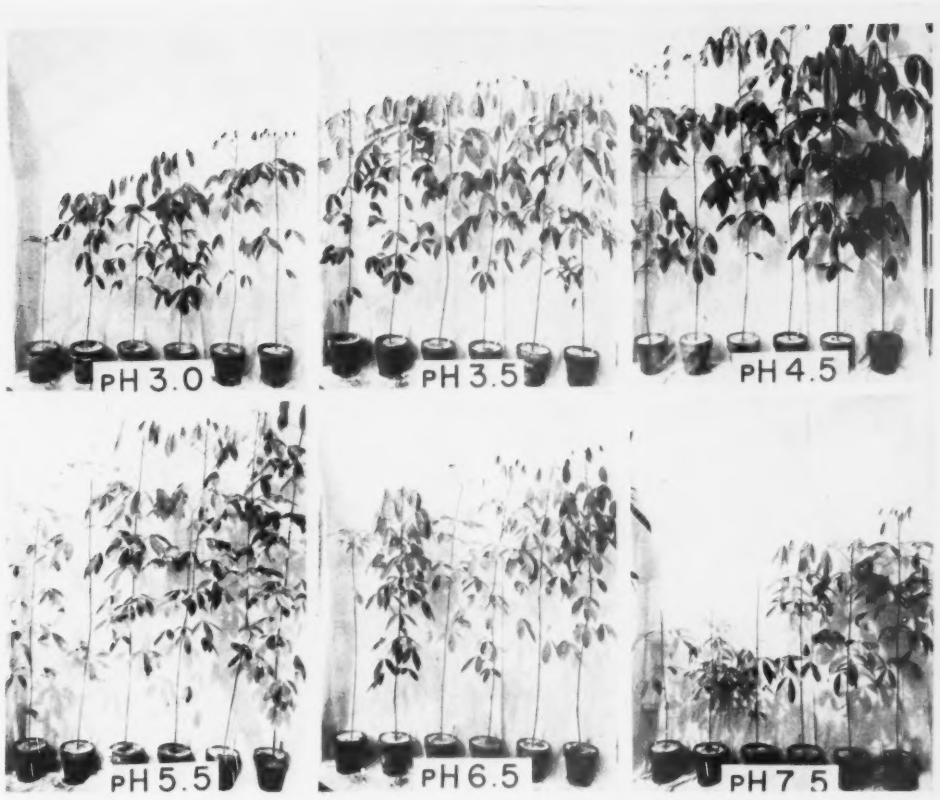

FIG. 3—pH range. Plants grown at various hydrogen ion concentrations are shown.

The plants closely resembled plants grown at pH 7.5, indicating that the injurious effect of high pH is a limitation of iron supply. New leaves were almost white and were abnormally small. Iron appears to be as critical as some of the major elements for the rubber tree.

This experiment failed to associate any great importance to the use of zinc, boron or manganese. It is probable that a longer period of study or the use of purer reagents and double distilled water would bring out deficiency symptoms.

Effect of Concentration of One Cation on the Absorption of Other Elements

It is known that the presence of one cation in appreciable concentration in a nutrient solution commonly results in diminished absorption of other ions. The data presented here indicate that the Hevea tree responds in the usual manner in its absorption phenomena. The apparent relationships are tabulated. Further work will be required to establish the rules. These phenomena are discussed in some detail as they have had little consideration in connection with rubber trees. Tables VI, VII and VIII give analyses.

1. Calcium depresses magnesium absorption. This shows up strongly in the leaf but only weakly in the petiole and stem.

2. Calcium depresses potassium absorption. The relationship is moderate from the stem data but weak from the leaf and petiole data.

3. Potassium depresses the calcium content moderately in the stems but weakly in the leaves and petioles.

4. Potassium depresses the magnesium content of the plant. This is strongly apparent in the leaves and petioles but weakly apparent in the stems.

5. Magnesium depresses calcium strongly in the leaves and stems but weakly in the petioles.

6. Magnesium depresses potassium strongly in leaves, petioles and stems.

7. A high acidity has a strong depressing effect on calcium and magnesium content but a weak effect on potassium content.

8. A high potassium level appears to lead to a low phosphate content.

The anions, phosphate and sulfate, have marked effect on nitrogen content. Both phosphate and sulfur are constituents of protein and a deficiency of either element probably limits protein synthesis.

Chapman *(1)* has already reported the following observations: (a) P depresses K of leaf; (b) K depresses P of leaf; (c) P depresses N of leaf; (d) N increases P of leaf.

TABLE VI—ANALYSES OF AIR DRY LEAVES

	% Ca	% Mg	% K	% Na	% P	% S	% N	% Ash	% Acetone Extract	% Benzene Extract	% N in Fallen Leaves
5% Mg	.93	.13	2.04	.10	.42	.214	3.71		9.3	7.3	1.89
No Mg	1.08	.10	2.28	.09	.37	.288	3.46	7.2	10.0	6.0	2.26
5% Ca	.36	.59	1.38	.09	.41	.257	3.61	4.1	14.4	8.6	2.65
No Ca	.19	.84	1.47	.26	.25	.228	3.17 3.70	4.5	12.5	8.4	2.45
5% K	.63	.66	.58	.11	.58	.264	3.43 3.79	3.9	14.3	8.7	2.13
No K	.66	.73	.60	.12	.55	.256	3.61 3.98	3.9	15.7	8.6	2.75
5% P	.67	.48	1.30	.11	.14	.234	2.80	2.7	15.6	7.8	1.52
No P	.54	.37	1.24	.12	.08	.213	2.67	4.0	15.7	6.4	1.63
5% S	.74	.46	1.23	.13	.38	.307	2.85	4.5	15.8	7.9	1.52
No S	.59	.34	1.55	.12	.44	.150	3.00 2.54	4.9	13.9	6.1	1.11
Complete, pH 3.0	.48	.34	1.09	.18	.36	.300	4.13	3.7	15.9	10.0	2.62
Complete, pH 3.5	.57	.37	1.09	.19	.40	.290	3.33	4.1	15.3	9.0	2.37
Complete S, pH 4.5	.73	.47	1.28	.18	.38	.299	3.54 3.33	3.2	13.2	7.5	2.16
Complete N, pH 4.5	.68	.29	1.22	.18	.29	.300	3.26 3.56	5.1	14.4	8.7	2.23
Complete, pH 5.5	.62	.37	1.27	.23	.31	.294	3.47 3.31	4.9	11.9	8.4	2.66
Complete, pH 6.5	.95	.62	1.40	.22	.36	.294	3.33 3.02	5.5	11.9	7.5	2.21
Complete, pH 7.5	1.16	.68	1.33	.23	.32	.278	3.02 3.13	6.0	11.6	7.9	1.71
pH 6.5, Fe sprayed	.56	.41	1.41	.26	.32	.303	3.28	5.1	11.5	7.8	1.80
High Fe	.63	.39	1.28	.21	.38	.292	3.32 3.36	4.3	14.1	8.5	2.84
High Mn	.88	.43	1.15	.21	.30	.280	3.34 3.37	5.1	13.6	8.8	1.95
No Zn	—	—	—	—	—	—	3.70 3.16	4.6	13.7	7.8	2.10
No B	.79	.29	1.18	.05	.59	.278	3.22 3.96	4.8	12.7	9.0	3.60
Low Ca	.71	.26	1.49	.05	.33	.302	3.44 3.39	5.1	13.6	8.8	3.47 1.95
High Ca	1.10	.09	1.20	.09	.39	.140	3.02	5.2	16.4	8.8	1.64

The "a" relationship is possibly inaccurate; Chapman applied the phosphate as calcium phosphate and probably got depressed K value from the calcium treatment.

Our own data appear in agreement with his "b" relationship. It may be that phosphate uptake is correlated with the combined uptake of calcium and magnesium.

Chapman's "c" relationship is entirely controversial with our observations. He may be working at a higher phosphate content where toxic effects are encountered.

Our nitrogen levels were not varied; our data cannot be used to check Chapman's "d" relationship.

Fertility of Tropical Soils

Tropical soils may vary widely in fertility depending on the parent rock, but generally they are poor in the mineral nutrient elements that plants require. A group of soils obtained from our Malayan plantations were analyzed for available nutrients by the Soils Department of the New Jersey Agricultural Experiment Station. Results on these lateritic soils are collected in Table III.

Table III illustrates the extremely infertile condition of the soils with which we must deal. The phosphate content, relatively speaking, appears to be somewhat higher than the cation contents. The calcium content is remarkably low; we can probably grow rubber trees on soils of this type only because the rubber tree has an extraordinarily low calcium requirement. The Rutgers Soils Department called our attention to the fact that the potassium content exceeded the calcium content, a circumstance unusual for soils of the temperate zones.

The fact that all cations are very low lends importance to the control of cation balance discussed in the preceding sections, as a moderate application of one cation will make a big change in the relative cation content.

Analyses of Tree Grown in Field: The Rubber Research Institute of Malaya has reported the complete analysis of a rubber tree (7). This mature tree was in good condition, showing no deficiency symptoms when felled. Some of these data are presented in Table IV, recalculated on the same basis as our data. The soil was of limestone origin. Analyses of tree samples, particularly leaves, may be quite valuable in indicating mineral deficiencies.

Phosphate Fertilization

Phosphates have frequently been observed to promote the growth of rubber trees and also to depress rubber yields. Frequently, no detectable effect has been noted. The effects of phosphate are discussed below:

(a) Some phosphate appears to be essential for normal development of the rubber tree. Applications on deficient soils may bring a direct benefit to the tree through supplying an essential element. It is widely believed that a high phosphate level retards rubber pro-

TABLE VII—ANALYSES OF AIR DRY PETIOLES

	% Ca	% Mg	% K	% Na	% P	% S	% N	% Ash
5% Mg	.56	.12	2.00	.15	.47	.107	1.48	
No Mg	.62	.07	2.47	.14	.58	.129	1.46	
5% Ca	.20	.43	1.34	.21	.32	.100	1.21	4.19
No Ca	.08	.45	1.46	.36	.45	.092	1.56	4.46
5% K	.54	.62	.30	.15	.49	.123	1.78	4.03
No K	.52	.68	.35	.29	.45	.110	1.69	
5% P	.57	.43	1.20	.04	.08	.085	1.33	3.71
No P	.53	.38	1.64	.07	.05	.096	1.11	
5% S	.59	.39	1.14	.07	.36	.071	1.26	4.17
No S	.52	.40	1.42	.06	.41	.165	1.31	
Complete, pH 3.0	.44	.36	1.29	.09	.52	.118	1.91	
Complete, pH 3.5	.46	.36	1.16	.07	.45	.111	1.72	3.52
Complete S, pH 4.5	.68	.43	1.30	.08	.35	.097	1.32	4.54
Complete N, pH 4.5	.67	.45	1.25	.05	.35	.102	1.50	4.61
Complete, pH 5.5	.61	.32	1.31	.20	.36	.096	1.45	4.64
Complete, pH 6.5	.70	.61	1.46	.20	.36	.096	1.28	5.74
Complete, pH 7.5	.90	.73	1.28	.35	.35	.122	1.48	5.80
pH 6.5, Fe sprayed	.77	.42	1.34	.20	.40	.100	1.20	4.86
High Fe	.49	.41	1.49	.07	.39	.085	1.44	4.36
High Mn	.52	.40	1.23	.09	.50	1.08	1.79	4.30
No Zn	—	—	—	—	—	—	1.46	4.49
No B	.72	.31	1.33	.05	.52	.007	1.69	4.78
Low Ca	.64	.30	1.31	.05	.37	.111	1.66	4.6
High Ca	1.48	.08	.90	.11	.39	.110	1.48	5.4

duction. This may be a direct effect of high phosphate levels or it may be one or more of the secondary effects discussed below.

(b) Phosphate applications are known to increase the cation exchange capacity of the soil. This may be beneficial or immaterial where the critical cations, potassium and magnesium, are adequate but may lead to an immediately unfavorable effect on the tree if the supply of essential cations is limited. Increase in cation exchange capacity without an increase in the available cations is expected to reduce the availability of the cations.

(c) Phosphate applications have a tendency to reduce iron availability. There is a direct precipitating effect on the iron in the soil solution and a corresponding precipitating effect in the plant when the phosphate content of the plant is raised. The rubber tree appears to have a high iron requirement and the unfavorable effect often noted following phosphate fertilization may be due to a reduction in iron availability. If this occurs, iron salt plugs inserted in the trunk or foliage spraying with iron solutions may prove to be beneficial with phosphate applications.

The problem is complicated by the fact that very acid soils which supply the plant with an abundance of iron rapidly fix phosphates as insoluble iron phosphates. It may be necessary to apply phosphates in a very limited area under each tree so that a portion of the roots can

TABLE VIII—ANALYSES OF AIR DRY STEMS

	% Ca	% Mg	% K	% Na	% P	% S	% N	% Ash	% Acetone Extract	% Benzene Extract
5% Mg	.62	.04	1.19	.05	.67	.171	1.93	—	5.1	2.2
No Mg	.53	.04	1.36	.05	.70	.164	1.59	—	5.0	—
5% Ca	.19	.21	.95	.08	.36	.124	1.30	—	5.4	1.5
No Ca	.14	.23	1.24	.11	.49	.174	1.66	—	3.9	1.6
5% K	.67	.19	.29	.09	.70	.158	2.07	—	4.5	1.5
No K	.43	.17	.23	.08	.69	.139	2.00	—	6.2	2.1
5% P	.58	.26	.63	.01	.08	.081	1.26	—	5.8	2.1
No P	.48	.23	.66	.08	.05	.072	1.10	—	5.2	1.9
5% S	.47	.17	.68	.04	.34	.056	1.15	—	4.5	1.5
No S	.51	.26	.78	.06	.50	.059	1.48	—	5.3	2.0
Complete, pH 3.0	.31	.08	.73	.04	.52	.214	1.93	—	5.6	2.4
Complete, pH 3.5	.42	.15	.58	.05	.55	.230	1.71	3.0	—	—
Complete S, pH 4.5	.39	.17	.76	.04	.39	.162	1.67	—	4.2	1.5
Complete N, pH 4.5	.53	.18	.76	.06	.28	.169	1.68	3.3	—	—
Complete, pH 5.5	.61	.21	.80	.10	.35	.141	1.68	3.5	—	—
Complete, pH 6.5	.61	.21	.85	.13	.29	.179	1.46	3.9	—	—
Complete, pH 7.5	1.09	.42	.84	.15	.24	.144	2.65	—	3.6	1.8
pH 6.5, Fe sprayed	.72	.24	.79	.05	.57	.137	1.38	3.8	—	—
High Fe	.54	.25	.78	.04	.48	.130	1.63	4.3	—	—
High Mn	.51	.18	.75	.03	.67	.179	2.14	—	4.0	1.6
No Zn	—	—	—	—	—	—	1.73	3.4	—	—
No B	.57	.21	.81	.01	.41	.134	1.66	3.5	—	—
Low Ca	—	—	—	—	—	—	1.94	3.4	3.8	2.0
High Ca	—	—	—	—	—	—	2.03	4.0	4.2	2.2

TABLE IX—AVERAGE DIAMETER AND HEIGHT AT HARVEST

	Diameter (in.)	Height (in.)
5% Mg	.283	53.6
No Mg	.271	47.5
5% Ca	.417	74.2
No Ca	.402	71.1
5% K	.395	62.0
No K	.268	37.6
5% P	.346	54.3
No P	.339	49.6
5% S	.409	75.6
No S	.308	44.1
Complete, pH 3.0	.280	41.8
Complete, pH 3.5	.342	60.8
Complete (South Group), pH 4.5	.439	73.7
Complete (North Group), pH 4.5	.434	73.7
Complete, pH 5.5	.407	76.0
Complete, pH 6.5	.364	63.5
Complete, pH 7.5	.330	46.0
pH 6.5, Iron Spray	.380	63.8
High Iron	.419	55.5
High Mn	.368	58.9
No Zn	.443	66.1
No B	.466	69.6
Low Ca	.406	63.8
High Ca	.382	62.7

Note: Plants on feeding trials from March 10 to September 26, 1947.

feed upon the phosphate before it is fixed. Broadcasting will lead to almost immediate fixing in many soils. A plan of this type may permit the tree to obtain its phosphate from a limited area and an abundance of iron from the remainder of its root feeding area. Soluble aluminum as well as iron may limit phosphate availability in acid soils.

Iron deficiency is less apt to show up with phosphate fertilizers in soils with high organic matter content than on soils with low organic matter content; it will also be less apt to show up in soils with a high ratio of ferrous to ferric iron than on soils with a low ratio; it is also less apt to show up on soils with a low manganese content than on soils with a high manganese content. All these things must be considered in connection with phosphate fertilization.

(d) Many phosphates contain appreciable quantities of calcium. Applications of these materials may be injurious in accordance with the phenomena discussed in the section on cation balance.

(e) Phosphates commonly contain sulfate salts. On soils that are extremely deficient in sulfur, these phosphates may give a beneficial action by correcting the sulfur deficiency. Other materials, such as basic slags, may give responses through supplying a deficient element such as magnesium or potassium. Great care must be exercised in the selection of fertilizer materials for research purposes and in the interpretation of results.

Progress Beyond Sand Culture Studies

The preceding study has indicated that the rubber tree has need for phosphate, potassium and magnesium in addition to the nitrogen that has been utilized so extensively in the past. The sulfur requirement is probably met in almost all instances by the sulfate included in ammonium sulfate, superphosphate or potassium sulfate commonly utilized in balanced mixtures. Four Malayan soils have been tested by pot experiments and have shown need for phosphate, potassium and magnesium to attain a vigorous growth. An extensive field experiment was set out in Malaya in 1948 to determine if supplements of potassium and magnesium would be beneficial for the growth of the rubber tree. All trees of this experiment are receiving nitrogen and rock phosphate. Phosphate deficiency has already been established for this soil. The experiment has not gone long enough to be conclusive.

Summary

1. Phosphate, potassium and magnesium appear to be the minerals whose deficiency is most likely to retard development in the field.

2. Elimination of sulfur severely retards the rubber tree. A very small amount of sulfur gives normal growth.

3. Elimination of calcium did not retard growth of these very young rubber trees.

4. The Hevea tree exhibits normal behavior on cation absorption relationships.

5. Adequate available iron supply is highly essential to the rubber tree. A high pH severely limits iron supply.

6. Maximum growth on culture solution is at pH 4.5 to 5.5.

7. The data indicate benefits in growth rate, improved stands and increased latex yield from applying critical minerals to balance the tree's nutritional supply.

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Brookfield Engineering Laboratories, Inc., Stoughton, Mass., is now marketing the **Brookfield Helipath Stand** which permits the testing, study and control of highly plastic materials, regardless of degree of thixotropy. When used with a suitable Brookfield Viscometer, it makes possible the measurement of many substances heretofore considered unsuited for viscosity or consistency measurements.

Several newly engineered components are reported to be incorporated in the **Autotronic Die Press** recently introduced by the Hobbs Manufacturing Co., Worcester, Mass. These include a complete electrical push-button system worked through an electronic panel with easy rheostat adjustments and the use of photo-electric cells which stop the unit if the operator's hands interfere with the beam during cycle.

Measuring the Load-Deflection Properties of Vibration-Control Mountings and of Elastomers

EVIDENCE of the variety of engineering problems presented by vibration is found in the size of the engineering and development laboratories at Lord Manufacturing Company, Erie, Penna. These laboratories form the keystone which supports the design, production, and application of vibration-control mountings made of rubber or related elastomers bonded to metal parts.

Although all vibration-control problems require intelligent analysis for solution, many of them present problems that call for specialized research to determine the most effective and economical type of mountings, or the specific type of elastomer that will meet all requirements. It is the job of the vibration engineer to supply customers with accurate and complete recommendations for solving their vibration problems. And it is the responsibility of the laboratory technician to provide the vibration engineer with basic data that assures the best possible recommendation.

To speed up the measurement of the load-deflection properties of vibration-control mountings and of the elastomers used for vibration control, and to improve the accuracy of these measurements, the Lord Engineering Research Laboratory recently acquired a new Model PTE Baldwin Universal testing machine of 5000 lb. capacity (Fig. 1). The speed-up is accomplished by use of an autographic recorder with which the machine is equipped.

Both the indicating hand, on a dial scale 60 inches long, and the recorder stylus are activated by an Emery hydraulic load cell acting through a pneumatically-operated, null-balance system. Deflections of mountings are measured by movement of the core of a miniature variable transformer (Microformer) mounted on the platen of the testing machine and activated by the moving crosshead. A similar Microformer in the recorder follows deflections of the sending Microformer and rotates the chart roll proportionally. Thus, the recorder automatically plots load-deflection curves when desired. Availability of several scale ranges is a factor in the high accuracy attained, it is reported. Accuracy in percent of reading is the same on every range of the machine.

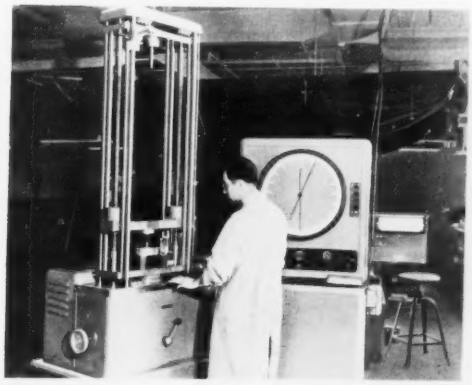

FIG. 1—Over-all view of the 5000-lb PTE machine for measuring and automatically recording the load-deflection characteristics of vibration-control mountings.

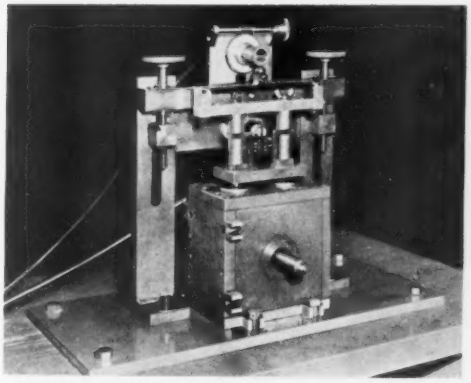

FIG. 2—This specially designed apparatus for measuring hysteresis and dynamic modulus of elastomers in a double sandwich specimen employs SR-4 resistance wire strain gages for force and displacement pick-ups.

The testing machine is in daily use both for tests of mountings and of the materials used in mountings. Since nearly all elastic mountings take advantage of the "softness" of elastomers in shear, and their low deflections in compression and tension for resistance to forces in other directions, standard test specimens consist of a double sandwich of the elastomer between three small, rectangular pieces of metal plate. Shear loads are applied downward on the edge of the center plate and upward on the two outside plates on the edges of which the specimen rests on the platen of the testing machine, as in Fig. 2. In this way comparative tests of elastomers, bonding materials and mounting designs are readily made.

Tube form mountings, such as the one shown in the Baldwin testing machine in Fig. 1, have a cylinder of the elastomer in shear under load, with high resistance to forces acting perpendicular to the direction of shear loads. The contour of the elastomer is designed to minimize shear at or near the edge of the bond with metal. This mounting is 6 inches in diameter and 4 inches long.

Dynamic Testing

Fig. 2 shows apparatus specially developed to measure hysteresis and dynamic modulus of elastomers. A double

sandwich specimen and its supporting frame are oscillated vertically at 15 to 60 cycles per second. Force and displacement pick-ups, consisting of thin-walled aluminum alloy tubes to which SR-4 resistance wire strain gages are bonded longitudinally, are supported as cantilever beams on a fixed structure.

The end of the force pick-up is fastened to the inner metal member of the double sandwich specimen. The displacement pick-up arm, which can be rotated by means of a worm gear, makes contact with a beam spring on the specimen supporting frame through a steel ball.

In operation, the displacement pick-up voltage signal through a Wheatstone bridge circuit and amplifier to a vacuum tube voltmeter is adjusted by rotating the pick-up arm to counterbalance the signal generated by the elastic component acting on the force pick-up. This leaves a minimum voltage signal proportional to the damping force component. Sufficient data are then available to obtain both the elastic and damping force components. The method is reported to be a considerable improvement on conventional flexometers with respect to time saving, and especially for elastomers having low hysteresis.

Simulated Service Tests

Simulated service tests of mountings and flexible couplings are made by means of a battery of vibration machines and rotational fatigue machines that were specially designed for the purposes of the laboratory. An interesting feature of the operation of some of these machines is the extensive use of SR-4 strain gages for automatic control of their operation. Single and multiple tests of elastomers in mountings and couplings are automatically stopped at failure of the material so that the number of cycles before failure may be counted for each specimen.

Backing up the vibration engineers is a staff of chemists whose job is the control of rubber compounds, careful analysis and physical check of production batches, and continual experimental work on new rubber and synthetic compounds with all of the varied properties needed to meet requirements, including methods of bonding the materials to the metal components of the mountings.

Over a period of 30 years, Lord has designed and produced more than 150,000 sizes and types of flexible mountings ranging in capacity from a few ounces to several thousand pounds. It has been found that no universal type of vibration-control mounting can be applied without careful consideration of the prevailing conditions. Since an infinite number of combinations of conditions are possible, the need for designing new mountings will continue indefinitely. Industry will meet every new challenge presented.

Dust Control System Aids Plastic Polishing Operations

TWENTY thousand plastic doll parts are polished in one day at the plant of the Ideal Toy Corporation in Hollis, N. Y. To achieve this high rate of production, special parts bins, work benches, polishing equipment, and a dust control system have been designed, laid out, and installed. Polishing not only improves the appearance of doll arms and legs but also removes traces of cement used to join the molded half-sections together.

Bins containing unpolished arms and legs are arranged, back to back, in two rows. Work is brought to the bins by the foreman so the operators won't lose working time. As shown in the accompanying illustration, the operators in one row face opposite those in the other. This arrangement permits each man to reach into his bin with the right hand. Bin fronts taper outwards and have V-shaped openings to direct the flow of the bin contents for easy reach of the operator. A lip-tray in front of each bin holds a few pieces of stock from which the operator works. Finished pieces are deposited in a fiber-drum container to the operator's left.

A large exhaust pipe runs under the bins and is connected by smaller 4-inch pipes to dust control exhaust hoods covering the polishing wheels. This piping system pneumatically conveys dust from the polishing machines to a Pangborn dust collector on the roof. The system collects the waste dust in a disposal hopper and prevents any dust from escaping into the plant.

The polishing machines themselves are placed on benches between the bins and the finished-parts containers. They comprise electric motors which have discs mounted on their spindles. Ends of strips of sandpaper are secured to the edges of the discs and the free lengths hit against the arm or leg being polished as the spindles rotate.

These machines, plus planned layout, plus adequate plant-housekeeping, enable Ideal Toy to polish record-breaking numbers of parts in a short time—a necessary requisite when producing for peak seasonal demand periods.

Arrangement of bins at the Ideal Toy plant, indicating the efficient dust control system.

Continuous Grinding. (Catalog No. 514). Patterson Foundry & Machine Co., East Liverpool, Ohio. 8½ x 11 in. 28 pp.

Features of Patterson ball, tube and rod mills are detailed in this catalog. Included in the catalog are over 50 illustrations; technical descriptions; and charts which show size, weight, linings, ball charge, speed, power requirements and motor sizes. Also, special consideration is given to accessory equipment, such as feeders and mill drives. In addition to descriptions of the mills themselves, complete Patterson continuous grinding systems are discussed.

Resistance of Floor Coverings to Grease, Oils and Selected Reagents

THE effects of grease, oils, alkalies, acids, and bleaches on 40 floor coverings from 17 different manufacturers have been investigated by P. A. Sigler and T. H. Boone of the National Bureau of Standards. Conducted at the request of the Office of the Chief of Engineers, Department of the Army, the tests were made on coverings ranging from such general types as vinyl, rubber, linoleum, asphalt, and printed enamel to several proprietary materials. The reagents to which these coverings were exposed included beef tallow, kerosene, cottonseed oil, lubricating oil, solutions of soap, sodium carbonate, trisodium phosphate, sodium hydroxide, acetic acid, sulfuric acid, and hydrogen peroxide.

As a standard testing technique for evaluating these properties was not available, a technique was devised which essentially measured the depth of a scratch caused by a "mechanical fingernail" after exposure of the material to the reagent for 24 hours. While this method has not as yet been thoroughly correlated with the scratch resistance of floor coverings in service, it has since been included in interim Federal Specifications for asphalt tile, No. SS-T-307 (GSA-FSS) of October 1, 1951.

In detail, the method involved the use of a Taber Abraser equipped with an attachment for measuring shear hardness to determine the softening effect of the reagents on the various floor coverings. The coverings were prepared for testing by cementing the surface of a 2- by 4-inch specimen on one end of a hollow sheet-metal cylinder, $1\frac{1}{2}$ inches in diameter. Ten milliliters of test reagent were poured into the cylinders, covered to retard evaporation, and allowed to stand for 24 hours. After the reagent and cylinder were removed from the specimen, the exposed surface was blotted lightly and examined visually for defects.

The specimen was then placed on the turntable of the Taber Abraser, and a 1-inch scratch made by means of a sharp-edged tool on a pivoted beam under a load of 500 grams. The tool was curved so that the scratch width was reasonably proportional to its depth. A scratch width of over 150 mils was considered to indicate a softening effect; a scratch width of between 100 and 150 mils, a slight softening effect, and a width below 100 mils, no softening effect.

Of the various floor coverings tested, the vinyl plastics were, in general, most resistant to grease and oils. With a few exceptions, they also showed fair to good

RESULTS OF TESTS ON RESISTANCE OF FLOOR COVERINGS TO VARIOUS MATERIALS

(E, excellent; G, good; F, fair; P, poor)

Material	No. of samples	Kerosene	Cottonseed oil	Lubricating oil	Beef tallow	Cleaner: 0.5% Soap, 0.2% Na_2CO_3	Na_3PO_4 1%	NaOH 1%	Acetic acid 5%	H_2SO_4 5%	H_2O_2 3%
Vinyl plastic, flexible	5	1-E 4-G	4-E 1-G	4-E 1-G	4-E 1-G	2-E 1-G 1-F 1-P	3-E 1-F 1-P	2-E 1-G 2-P	1-E 1-G 2-F 1-P	2-E 1-G 2-P	2-E 1-G 1-F 1-P
Vinyl plastic, felt-backed	3	3-E	1-E 2-G	3-E	3-E	1-E 2-G	2-E 1-G	3-E	1-E 2-F	1-E 2-G	2-E 1-G
Vinyl plastic, cork-backed	2	1-E 1-G	2-E	2-E	1-E 1-G	2-E	1-E 1-F	1-E 1-F	2-E	2-E	2-E
Vinyl plastic, semi-flexible	3	2-G 1-F	2-E 1-G	3-E	1-E 2-G	3-G	2-E 1-G	1-E 1-G 1-F	1-G 1-F 1-P	2-G 1-F	1-E 2-G
Asphalt tile, grease resistant	4	1-E 1-F 2-P	1-E 2-G 1-P	2-E 2-G	1-E 3-G	3-G 1-P	1-E 2-G 1-P	2-E 1-G 1-F	1-G 3-P	1-E 3-P	4-G
Asphalt tile, regular	7	7-P	7-P	2-E 1-G 1-F 3-P	1-G 6-F	5-G 2-F	6-E 1-G	3-E 4-G	4-G 1-F 2-P	1-G 3-F 3-P	3-E 4-G
Linoleum, felt-backed	4	4-P	2-E 1-G 1-P	2-E 1-G 1-P	1-E 3-F	2-F 2-P	4-P	4-P	4-P	1-E 1-F 2-P	1-E 3-P
Linoleum, burlap-backed	2	2-G	2-E	2-E	2-E	2-F	1-F 1-P	2-P	1-F 1-P	1-E 1-G	2-F
Rubber	3	1-F 2-P	1-E 1-F 1-P	2-E 1-F	3-E	1-E 1-G 1-F	2-E 1-F	1-E 2-P	1-G 2-F	1-F 2-P	1-E 1-G 1-F
Enamel print, felt-backed	3	1-G 2-P	1-E 2-G	1-E 2-G	2-G 1-P	1-F 2-P	3-P	3-P	3-P	1-G 2-P	2-F 1-P
Mastic composition, felt-back	2	2-P	1-E 1-G	1-E 1-G	2-F	2-G	1-G 1-P	2-P	2-F	2-G	1-E 1-G
Resin composition, felt-backed	1	P	G	E	E	F	E	F	P	P	G
Cork composition	1	G	E	E	E	G	G	P	F	E	G

resistance to alkalies, while a number of the plastic floor coverings were adversely affected by dilute acids.

The regular asphalt tiles showed very poor resistance to most of the oils and only fair resistance to beef tallow. Some of the so-called "grease-resistant" asphalt ties were not outstanding as regards grease and oil resistance, and most showed poor resistance to dilute acids.

All of the linoleums were materially affected by alkaline cleaning solutions and were partially disintegrated by a 1% solution of sodium hydroxide. They provided poor resistance to acids and hydrogen peroxide, and with the exception of brown battleship linoleum, were appreciably softened by kerosene. Several were also slightly softened by beef tallow.

None of the rubber tiles withstood the effects of kerosene but all were resistant to beef tallow. Their resistance to dilute acids and alkalies varied from good to poor.

In general, the enamel-print felt-base floorings were damaged by alkaline cleaners, dilute acids, and kerosene. The mastic (bituminous) felt-backed floor coverings provided poor resistance to kerosene and were slightly softened by beef tallow. A proprietary floor covering having a resin-composition wearing surface showed fair to good resistance to the various oils and reagents with the exceptions of kerosene and dilute acids. A cork-composition flooring gave fair to good resistance for the various oils and reagents with the exception of sodium hydroxide.

From an over-all viewpoint, the vinyl plastics tested possessed the best properties for use in locations likely to be subjected to frequent exposure to grease, oils, and alkalies. However, at least one of the vinyl plastic samples showed a poor resistance to five of the 10 reagents, and it is questionable if vinyl plastic floor coverings can be satisfactorily installed on concrete subfloors which are in direct contact with the ground unless the concrete floor has been thoroughly membrane waterproofed. Asphalt tile, on the other hand, can be successfully laid on a concrete floor which is subject to damp conditions.

None of the reagents was highly destructive to all of the samples. At least two of the materials showed excellent resistance to each reagent. Although materials of a given type tended to be resistant to the same reagents, the differences between the resistance of individual samples of a given material was large enough to indicate the desirability of testing samples of floor coverings where severe conditions are anticipated.

New Process Integrates Carpeting and Foam Rubber

A NEW PROCESS, integrating a foam rubber backing with carpeting, is being introduced by Collins & Aikman, carpet and rug manufacturers with headquarters in New York City and factories in various parts of the country. The process is reported to have a great many advantages over previous methods of bonding foam rubber to carpeting by means of adhesive.

The new method applies the foam rubber composition directly to the fabric in the form of a thick cream, solidifying into a foam rubber pad that is an integral part of the carpet. This method avoids any possible lack of adhesion that might occur when rubber is cemented to a carpet as a secondary application. It also makes unnecessary the use of heavy backing threads, thus saving some cost which can be applied to a stronger wearing surface. The denser weave and lower pile height made possible by this process also adds to the wearing quality of the carpeting.

No binding of edges is necessary with this new process, and the carpet can be cut easily into any irregular pattern, or be die cut. Since color can be incorporated in the foam rubber to match the color of the carpet, no unsightly edges appear.

Water will not penetrate the rug, thus offering quicker drying; and dirt and dust cannot infiltrate the carpeting, making easy vacuum cleaning possible. Vibration and sound are minimized, an important factor in the automotive and transportation field.

Tests have shown that carpeting is more durable when placed over foam rubber; the integration of the carpeting with the foam rubber in this manner tends to increase this durability, makes for easier handling, and is more economical.

Collins & Aikman has found the process suitable for fabrics made from nylon, animal fibers, carpet viscose, and blends of all three of these fibers. Sample installations have been made in the automotive field.

The foam rubber backing can be applied to a thickness of five-eighths of an inch. Control of temperature during application, and aeration of the foam rubber, eliminate all odors.

Comparison of the old and new methods of using foam rubber with carpeting. The old method (left) requires heavy backing plus adhesive. The new method (right) avoids use of adhesive, cuts down on need for heavy backing, and permits a denser pile if desired.

Production of a new **shut-off valve** designed especially to protect gauges in both pneumatic and hydraulic systems has been announced by the Sprague Engineering & Sales Corp., Gardena, Calif. It is available for both low and high pressure use. Positive opening and closing action on the valve is said to eliminate the need for a relief valve and a manually-operated gauge shut-off valve.

American Hydrotherm Corp., Long Island City 6, N. Y., has introduced a line of **liquid phase heat transfer equipment** to operate at temperatures up to 800° F. The equipment is offered as individual components adaptable to large industrial requirements or as "tailored" package units for smaller installations. Package units range in size from small units of 3 kw to 1,000,000 Btu per hour.

Editorials . . . . . .

Maximum Discounts

AS detailed elsewhere in this issue, the five-man Federal Trade Commission has invoked the "quantity discount rule" for the rubber tire industry, effective April 7. In its simplest terms the order means that beginning April 7, 1952, no tire manufacturer can give any customer a larger discount than the discount he allows on a 20,000 pound carload of tires or tubes. Whether a purchaser secures 5, 10 or 15 carloads of tires or tubes he still may not be given a better price than the purchaser of a single carload.

The authority to promulgate rulings of this kind has been vested in the FTC since Congress passed the Robinson-Patman Act in 1936. Up until the tire ruling, FTC avoided fixing maximum quantity limits for any single product or group of products, although in a number of instances it has laid down regulations requiring that discounts be available on proportionately equal terms to all competitors. Such rulings were of little benefit to the average independent tire dealer who cannot afford to buy tires in carload lots. Many of them cannot even afford to make purchases in truckload lots.

Independent tire dealers, led by such partisans as George Burger, have carried on a vigorous campaign for years to force the Federal Trade Commission to utilize the full powers vested in it with regard to maximum quantity discounts. The action that led most directly to the issuance of the current ruling was started in 1947 at a hearing before the House Small Business Committee of the 80th Congress. At that hearing the FTC spokesmen were put directly on the spot when Committee Chairman Walter Ploeser (Rep., Mo.) wanted to know why the commission had never enforced the maximum quantity provision permitted by the Robinson-Patman Act. Subsequently, the commission launched an investigation into tire selling practices, held a number of special hearings, and finally took the current action.

In taking the action, the government once again has made the rubber manufacturing industry a guinea pig, a role the industry seems destined to occupy. There is little doubt that the question of the legality of the ruling will be carried all the way up to the Supreme Court for a final decision, since the tire manufacturers, especially U.S. Rubber and Goodrich, already have indicated they would fight the ruling. Preliminary legal skirmishing will probably start in the Federal District Court in Washington, where the tire producers will undoubtedly seek a temporary injunction. The guinea pig angle can be recognized from the fact that although the quantity limit rule applies only to tires and tubes, almost any product or commodity can get the same treatment at any time.

There is much to be said on both sides of the fence where the FTC ruling is concerned. The controversial aspect of the problem is best indicated by the fact that Lowell B. Mason, one of the five FTC commissioners, voted against the ruling, and in a dissenting opinion warned that the effect of fixing a maximum quantity discount prevents a seller from passing on by appropriate price reduction economies that may be achieved from the sale of a larger quantity. Thus, he pointed out, "we reject efficiency for the sake of avoiding damage to competition arising out of price differences."

Irrespective of the merits of the decision, trade circles are already discussing the over-all effect on the tire industry if the decision is upheld by the courts. One definite effect will be an increase in the price of tires and tubes. More important will be the foreseeable expansion of tire operations by the larger mail order houses and chain store organizations. Such expansion will probably occur in one of two ways: (*1*) They will either contract with manufacturers to make tires for a set processing fee from raw materials furnished to them by the purchaser, or (*2*) They will arrange to take over some manufacturer's total tire output. Some of them may go even further, and enter the tire manufacturing business. Whatever action they may take, the FTC ruling bids fair to cause quite a stir in the tire field in coming months.

Legal Problem

AN interesting problem in connection with the policing of the rubber industry has arisen in connection with the latest amendment to Order M-2, which became effective at the beginning of the year and which relaxes most of the previous controls. Under the new regulation, GR-S has been removed from allocation and manufacturers can use all the new rubber they desire providing each item produced has no more natural rubber in it than allowed by the specification controls which still continue in effect. Heretofore a company using more natural rubber than legally permitted could be punished by being forced to shut down. This could be easily and quickly accomplished by the simple expedient of denying the company involved the right to purchase any further new rubber. A recent issue of the *Akron Beacon Journal* raised the question of how such policing will be accomplished in the future, now that manufacturers are permitted to purchase GR-S without allocation. Let's hope that the industry gives Washington no cause to find a solution to that puzzler.

NEWS OF THE MONTH

JANUARY 1 REVISION OF NPA ORDER M-1 LIFTS CURBS ON TOTAL NEW RUBBER USE

AS reported in the December issue of RUBBER AGE, the government, on December 4, outlined plans for a sweeping relaxation in its restrictions on consumption of rubber in the United States. Subsequently, the National Production Authority, on December 14, issued a new M-2 order making effective as of January 1, 1952, all the changes previously announced. In issuing a drastically scaled-down version of its rubber order, NPA, in effect, has invited rubber manufacturers to boost 1952 output to whatever level the industry finds feasible. Rubber will be made available, if the industry wants it, for a 1952 consumption of about 1,300,000 tons, somewhat above the record attained in 1950, when there were very few controls. The scaled-down restrictions will limit the industry's use on only natural rubber and Butyl rubber. Natural rubber consumption will be held to the current rate of 30,000 tons a month at least to July, 1952, according to current estimates. Butyl is the only synthetic rubber being held under allocation. However, the government may ask the Congress for approval of a plant construction program to boost Butyl capacity nearly 50% above the current 85,000 tons-a-year level.

On January 1, government restrictions on the consumption of GR-S were removed. It is estimated that some 800,000 tons of GR-S will be available in 1952, approximately double the amount available in 1951. Usage limits are off natural rubber latex, and private industry will again be able to buy in foreign markets when the government steps out as exclusive buyer on or about March 31.

The revised Order M-2 specifically provides that, effective January 1, limitations on total new rubber used by industry are removed. While GR-S will no longer be allocated, the Reconstruction Finance Corp., as sole supplier, will sell only to regular consumers or those holding Government export licenses. An export quota has been set up for the first time to permit exports of 10,000 tons in the first quarter.

Purchasers of GR-S will be limited to the extent that they cannot take more than 46 per cent of their dry-GR-S (non-latex) purchases in the form of "cold" rubber. Butyl will remain under allocation, with separate allotments, both keyed to base period use, for non-transportation and transportation products.

Manufacturers' Inventories

Manufacturers' inventories of GR-S and Butyl will be held to a 30-day supply, while natural rubber stocks will be held to a 60-day supply. While not subject to direct base period allocation, natural rubber consumption will be limited by the mechanism of end-product specifications which set percentage limits on the natural rubber which may be used in thousands of products, banning its use entirely for some products.

The rubber industry, now hopeful that private importation of natural rubber can be resumed within three months, has submitted to General Services Administrator Jess Larson a plan providing for a gradual withdrawal of government purchasing over a four-month period.

Recalling Mr. Larson's statement that the natural rubber stockpile goal should be reached early in 1952, industry sources have assumed that the stockpile target will have been achieved by March 31, 1952, at the latest. It is expected that GSA will be able to determine in the near future whether the stockpile target can be reached by the end of March. If this be the case, it is suggested that private importation begin as of February 1, and public importation end by June 1. The plan urged that both government and industry should purchase natural rubber for April and May delivery.

Under the plan, industry would have the option of filling its April and May requirements through private importation or from government purchases. However, by June, 1952, industry should be able to accept complete responsibility for natural rubber procurement and the only government rubber available for industry consumption would then be stockpile rotation rubber.

During the period of combined industry and public importation, industry would not be permitted to pay more for their rubber than the GSA selling price. This practice would prevent an inflationary trend in world rubber prices. Removal of GSA control over natural rubber importation would still leave the government with considerable authority over the rubber industry.

Growing synthetic production and technological developments in that field are said to be contributing factors to the government's relaxation of curbs on the consumption of new rubber. W. Stuart Symington, at that time still administrator of the Reconstruction Finance Corp., said in a recent address before a group of Chicago bankers that the price of synthetic is sure to be reduced in the future, mainly on account of technological advances.

[On January 7, President Truman accepted the resignation of Mr. Symington as administrator of the RFC and named Harry A. McDonald, formerly chairman of the Securities and Exchange Commission, to succeed him. Mr. McDonald told the press that he would continue Mr. Symington's policies in the RFC.]

Synthetic Rubber Earnings

In line with Mr. Symington's prediction on the price of synthetic rubber, the RFC, in its annual report, stated that the government had earned $11,927,793 in the fiscal year ended June 30, 1951 from the synthetic rubber program. The figure represented income after deductions for expenses. The financial statement indicated that the profit would have been even higher except that it cost RFC $20,565,139 to put some of the plants back in service.

The biggest single expense item was for $178,524,316 which is what the agency reported it spent on materials from which the rubber is made. Processing costs ran to $44,223,595. Research, depreciation of plants, storage and handling charges, fire losses and administrative expenses were chief among the other costs.

The report showed 28 plants in the synthetic rubber program now in operation —13 for making GR-S, 2 for turning out Butyl, 10 for butadiene, and 1 for styrene. There is also 1 chemical plant and a laboratory at Akron.

Explosion at Butadiene Plant

The synthetic rubber program received a set-back, however, when an explosion rocked the butadiene plant operated by the Phillips Chemical Co. at Borger, Texas, on December 21. Fire was still raging, though under control, 12 hours after the explosion ripped through the plant. RFC estimated that damage in the amount of $2,500,000 based on early reports was too high. The final damage figure has not as yet been determined.

Officials said shifts within other butadiene plants may be able to offset a large part of any production loss at Borger. The facility damaged produces about 56,000 tons of butadiene a year. A neighboring

polymer plant, also operated by Phillips and supplied by the butadiene facility, produces about 30,000 tons of GR-S a year. Phillips has been given blanket government authority to order materials and equipment needed to repair the damage.

Reports New Production Technique

A new technique that will boost production capacity of synthetic rubber by 26% is being used at the synthetic rubber plant at Institute, West Va., officials of the B. F. Goodrich Chemical Co. announced recently. The process, using sugar and other activators, was developed by Goodrich Chemical, which operates the plant for the government. Officials said the formula is the first to be applied to the production of "hot" synthetic rubber, which is made at 122° F. as contrasted with "cold" rubber made at 41° F.

The Institute plant, which has a rated capacity of 90,000 long tons a year, is currently producing at the rate of 102,000 long tons a year, more than 13% over the rated capacity. The plant is exclusively a hot rubber plant. Reactivated in a three-month period, it began production in January, 1950.

Goodrich Chemical has also reported a new chemical "shortstop" for use in the production of GR-S. The new chemical, called Good-rite Shortstop 3955, is effective in both the hot and cold processes for making synthetic. The polymerization reaction between butadiene and styrene is stopped at 60-75% completion by the chemical, the company says.

Naugatuck Chemical Division of the U. S. Rubber Co. has reported an increase in synthetic output of more than 12,000 tons yearly at the synthetic rubber plant it operates for the government at Port Neches, Texas. Production gains were brought about by the use of giant conveyor belts made of stainless steel. One of the big improvements that paid off in increased production was the installation of eight new stainless steel drier flights for conveying wet crude rubber through drying ovens. Stainless steel conveyor belts are admirably suited for this purpose, the company states, with the result that production at the plant, rated at 69,000 long tons yearly, is now 72,000 long tons.

Synthetic production received impetus from another source when the Roosevelt Oil and Refining Corp., Mt. Pleasant, Mich., announced that facilities now being expanded will have an annual production capacity of 3,000,000 gallons of benzene and 3,250,000 gallons of toluene.

Sulfur Under Tighter Controls

The long postponed action putting sulfur and sulfuric acid under tighter controls was promulgated by NPA through the issuance of Order M-94 on January 1. Also amended was Order M-69, the basic sulfur order, while Schedule 3 to Order M-45 was revoked. The amendment to M-69 restricts the use of sulfur to 90% of the 1950 use and sets up the machinery for supporting military and defense requirements through the issuance of directives to sulfur suppliers.

M-2 Supplement 1 Revoked

NPA, on January 7, revoked Supplement 1 to Order M-2. The action was procedural and did not in any way affect the substance of the rubber control program. Supplement 1, issued February 19, 1951, had contained certain manufacturing specifications for tires and tubes and industrial rubber products. All of the specifications were included in NPA Order M-2 as amended March 1, 1951. Appendix A of M-2 contains the language of Supplement 1. Since M-2, as amended December 14, 1951, made some changes in the provisions of Appendix A, NPA considered it advisable to formally revoke Supplement 1.

The new Order M-94, covers sulfuric acid and makes it mandatory for integrated producers to maintain the same ratio between market sales and captive use as they maintained in 1950. The objective is to prevent producers from keeping a disproportionate share of their output for their own use.

Sulfur will continue under the inventory restriction of NPA Regulation No. 1, but in addition no single shipment of more than 60 tons may be received in any calendar quarter by a user, and then only if he has less on inventory than permitted by Regulation No. 1. Suppliers are also forbidden to deliver more than 20 tons of 100% sulfuric acid to any purchaser unless he is provided with a statement reporting the proposed use of the acid.

Pricing News of Interest

The Office of Price Stabilization in an amendment to CPR 62, covering manufacturers' sales of tires and tubes to private brand owners, made available additional pricing methods to conform with the practices of certain segments of the industry. The alternate methods are prescribed in Amendment 1 to CPR 62, effective December 17, 1951.

CPR 62 is essentially a cost-plus regulation and sets forth three pricing methods: (1) fixed price per tire or tube, (2) aggregate pricing, and (3) freeze of pre-Korea cost-plus contracts. OPS has learned that in some instances, manufacturers sell to private brand owners on the basis of specified percentage discounts from the manufacturer's brand prices. The discount is adequate to recompense the private brand owners for the costs and risks of promotion and distribution which a manufacturer would incur with respect to his own brand. Subject to OPS approval on application, manufacturers are permitted, under the new amendment to sell to private brand owners on this basis if they made such sales during the period January 1 to June 30, 1950.

The amendment also provides for sales by certain private brand owners such as, for example, purchasing cooperatives, to affiliated or controlled outlets on the basis of cost-plus contracts if such existed during the period January 1 to June 30, 1950, and are filed with and approved by OPS. Prior to the issuance of the new amendment, these intermediate distributors, who are under the GCPR, could not pass through increased manufacturers' costs as their cost-plus contracts have provided.

A third provision removes from the coverage of CPR 62 private brand tires and tubes sold as original equipment for vehicles, such as industrial trucks, sulkies, bicycles, other vehicles, lawn mowers, etc. Such original equipment will be covered by a special original equipment regulation to be issued later, and for the time being, will be priced under GCPR.

The percentage of the tire business affected and the extent of any possible price changes which might occur under the amendment are so small that the effect of the amendment on tire prices will be negligible, OPS said.

OPS has also disclosed that it is planning to roll back the ceiling prices of camelback from 4 to 14% below present levels. The government agency told an industry advisory committee that the reduction will reflect a 14c a pound drop in the price of natural rubber put into effect in July of 1951. Camelback is now covered by GCPR, which pegs ceilings at the highest level prevailing a year ago.

The industry group asked OPS to make allowance in the new ceilings for a recent increase in the government's selling price of synthetic rubber, which went up 1.5c a pound in the fall of 1951. An official announcement is now pending in an amendment to SR 10 of CPR 22.

Amendment 38 to CPR 22, issued December 20, 1951, placed titanium dioxide under control of CPR 22. This is in contrast with most metallic oxides which are priced under GCPR. The effective date of the order is December 26, 1951.

Topical Notes and Addenda

Manly Fleischmann relinquished his dual role as Administrator of both the National Production Authority and Defense Production Administration on January 7, when Henry H. Fowler was named as NPA Administrator. Mr. Fleischmann will now devote his time entirely to programming and requirements with special emphasis on the international materials situation. It is understood that Mr. Fowler, who has been deputy NPA Administrator since last September, will keep the agency in the strict role of an operating organization—the original role of NPA in the defense production program.

Morris S. Rosenthal, president of Stein, Hall and Co., New York, N. Y., upon his return to this country from a government mission to the Far East, said that Southeast Asian countries cannot be forced into embargoing shipments of raw materials to Communist bloc nations. Any U. S. efforts to get such a ban imposed would be unsuccessful, he said. Mr. Rosenthal was one of two businessmen in the seven-man American mission to the trade promotion conference held in Singapore recently by the Economic Commission for Asia and the Far East.

SPI COATING DIVISION HOLDS THIRD ANNUAL CONFERENCE IN NEW YORK

A number of interesting papers were presented at the Third Annual Plastics Film, Sheeting and Coated Fabric Conference sponsored by the Society of the Plastics Industry, Inc., on December 13 and 14 at the Hotel Commodore in New York City.

Among papers of particular interest was one on "A Study of Plasticizer Migration", by C. M. Grafton and J. R. Geenty of Goodall-Sanford, Inc. The work described in this paper was carried out by the late C. M. Grafton, and was presented at the conference by Mr. Geenty.

In his paper, Mr. Grafton stated that plasticizer migration in vinyl compounds might be defined as gradual diffusion of plasticizer from an area of given plasticizer concentration to an area of lower plasticizer concentration. The rate of migration is important in many uses of vinyl resin, particularly in upholstery where fast migration will cause stiffening of the vinyl compound by passage of the plasticizer into the cloth. This may result in enough plasticizer loss to cause cracking.

Migration Study Results

Migration studies were undertaken at the Plastics Division of Goodall-Sanford several years ago, and the migration test method proposed in this paper is the culmination of this work. The author stated that the test had all the desirable characteristics. The procedure consists simply of burying weighted test pieces in a fine highly absorbent powder, under moderate pressure to insure intimate contact. The powder is changed at suitable intervals, and the test sample re-weighed as desired to obtain weight loss.

Dr. A. J. Carter of the Chrysler Corp. presented another interesting paper at the conference. Dr. Carter spoke on "Vinyl Film, Sheeting and Coated Fabrics in the Automobile Industry". He said the story of vinyl film, sheeting and coated fabrics in the automotive industry is the story of the utilization of these materials for trim, upholstery and top applications.

The speaker reviewed the history of upholstery materials in the automobile through the use of leather and pyroxylin materials. He covered the use of rubber-coated fabrics which were used to replace pyroxylin through the early days of World War II when the shortage of rubber saw the application of vinyl-coated fabrics.

Holds Symposium on Film

The afternoon session on December 13 featured a symposium on "Calendered, Cast or Extruded Film?" Four pertinent papers were heard at the symposium, the first of these being "Characteristics of Calendered, Cast and Extruded Film" by Dr. M. G. Robinson of the Bakelite Co. This was followed by a paper on "Calendered Film" by N. J. Elder of the Adamson United Co. This paper represented an attempt to outline the major advantages of calendered film as opposed to casting and extrusion methods.

Mr. Elder stated that it is generally realized that, since the end of World War II, there has been a remarkable expansion in the usage of most types of films. Calendered vinyl film has enjoyed an expanding market for several years, and improvements in calendering and accessory equipment, as well as operating and compounding know-how, have made it possible to produce better material at lower unit cost.

In a paper on "Cast Film", D. G. Higgins of the John Waldron Corp., defined the art of film casting as the process involving the deposition of a continuous layer of film forming material on a moving supporting base. The speaker confined his remarks principally to the vinyl chloride polymer and copolymer resins. The speaker also attempted to answer two of the most common questions asked about the film casting operation; (1) How fast will it operate? and (2) Does the film cost more than the calendered or extruded film?

Mr. Higgins concluded that film casting equipment offers the most versatility of production of any of the methods of film manufacture. It is a complete production unit in itself. It is also a useful supplement to the requirements of calendered film manufacture, he said.

The last paper at the symposium was entitled "Extruded Film" by Willard deCamp Crater, Jr., of the Naugatuck Chemical Division of the U. S. Rubber Co. Mr. Crater said that extruders of both ram and screw types have been used to fabricate rods, shapes and tubes from rubber, explosives and plastics for many years. The use of extruders for the production of sheeting and film, on the other hand, is relatively new.

Possibilities for Extrusions

Although considerable work was done prior to World War II, the developments and progress made during the post-war period, both in machines and materials, clearly demonstrate that the extrusion process can open many new markets. Mr. Crater discussed some of the recent developments in this field and considered such matters as die design, quality and economics.

As for the future, the speaker noted that extruded polyvinyl chloride film is now on the verge of real commercial exploitation. Because of its strength, clarity and feel, it should play a major role in the markets for thin gauge film.

"Epoxy Compounds as Stabilizers" was the title of another paper, this one by F. R. Hansen of the Ferro Chemical Corp. Mr. Hansen stated it is a well-established fact that, under most conditions of degradation of polyvinyl chloride and its copolymers, hydrogen chloride is liberated. The initial rate of hydrogen chloride liberations, however, is quite small, and were the initial rate to be maintained, the degradation of the polyvinyl chloride would not present too much of a problem.

Hydrogen chloride, however, acts as a catalyst in the degradation of PVC, so that, in an unstabilized PVC, the initial rate of degradation is not maintained. The reaction is self-catalytic and proceeds at an ever-accelerating rate until the rate of diffusion of hydrogen chloride from the plastic or some other factor causes the degradation to become somewhat constant.

Since the epoxy type compounds react readily with hydrogen chloride, it is quite logical that these compounds were investigated as stabilizers for PVC. Most of the epoxy compounds used for stabilization of PVC are polymers of epichlorohydrin and polyals and have been polymerized through the epoxy groups of the epichlorohydrin so that the final molecule is generally conceded to have two epoxy groups, one at each end of the molecule. Thus, the higher the molecular weight, the lower the epoxy content, the speaker stated.

Vinyl Plastics in Flooring

In a paper on "The Future of Vinyl Plastics in Floor and Wall Coverings", G. E. Field of the B. F. Goodrich Chemical Co. made three basic points: (1) Vinyls will definitely upgrade the quality of any floor or wall covering material; (2) The economics of using vinyls or any other synthetic material in place of natural products is the chief hurdle to overcome; and (3) Since vinyls are so versatile, the possibilities of getting over the economic hurdle through the use of vinyls are much better than with any other synthetic material.

G. B. Foster of the Industrial Nucleonics Corp. spoke on the "Beta Ray Gauge" at the conference and stated that the instrument was the answer to many of the problems facing process control engineers, production managers, machine designers and cost accountants in the plastics industry. Mr. Foster discussed the range of present instruments and their application in the plastics industry. An actual operating model of one of the company's beta ray gauges was on display during the conference.

Other Meeting Features

Opening remarks at the conference were made by H. R. Thies of the Goodyear Tire & Rubber Co. The meeting also featured two luncheon sessions on each of the meeting dates. Papers presented at the conference, other than those discussed above, included:

"Printing and Styling Trends" by Lurelle Guild, Lurelle Guild Associates.

"Radiant Heat for Vacuum Forming, Fusion and Embossing" by Dr. Geoffrey Broughton, Lowell Textile Institute.

"Economic and Financial Trends in the Vinyl Film and Sheeting Market" by A. James Mill, Mill Factors Corp.

"The Possibilities of Promulgating Trade Practice Rules for Vinyl Film" by William T. Cruse, executive vice-president, SPI.

"Chain Store Merchandising of Plastics Film" by Thomas E. Whitemen, F. W. Woolworth Co.

Formation of a Marketing Committee and expansion in scope of the functions of the Public Relations Committee has been approved by the board of directors of the Society of the Plastics Industry, Inc.

WESTERN HEMISPHERE RUBBER NOW FEASIBLE SAYS LITCHFIELD

Plantation rubber now can be grown successfully and economically in the Western Hemisphere, P. W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Co., revealed in the latest issue of his "Notes on America's Rubber Industry." Mr. Litchfield's statement is found in New Series Number 16, "A Living Stockpile for National Security."

Fifteen years of cultivation on 2,500 Goodyear acres in Costa Rica has demonstrated that natural rubber of the plantation variety can be produced there at sufficiently low cost to compete with the output from the Far East, Mr. Litchfield writes. Goodyear technicians, working with experts from the U. S. Department of Agriculture, also have overcome the serious leaf blight which previously afflicted the native Para rubber tree when closely cultivated in plantation form in Central and South America, he disclosed.

Underlying significance of these developments, Mr. Litchfield points out, is that the United States by intelligent planning can lessen the ominous perennial peril of being cut off from our source of natural rubber supply. "We can create a living stockpile in this hemisphere and thus cut down the present strategic storage program," he states. "In so doing we will not only be relieving some of our national apprehensions caused by uncertainty of rubber supply in time of grave emergency but we will be saving money for our taxpayers."

Mr. Litchfield suggests that 300,000 acres of new rubber plantings, which ultimately would yield 150,000 tons of natural rubber annually, be developed in the climatically suited zone stretching from the southern part of Mexico to Brazil and Bolivia. He estimates the cost of such development at $100,000,000 spread over a six to seven year period up to the point of tapping the trees. "Thereafter, on the basis of existing wage levels, it would be on a self-liquidating basis," he added.

"As against this figure, the annual cost of maintaining a five year stockpile of natural rubber in this country at an average of 45 cents per pound is approximately $28,000,000 which includes $19,000,000 in annual interest on our cash outlay and about $9,000,000 annually for freight, warehousing and distribution involved in rotation of stocks. Any reduction in the price of natural rubber would of course reduce these interest charges. But this expense, wherever it may level off, goes on and on whereas the cost of establishing new plantations would cease after six or seven years, which is the time required to bring new plantings into bearing."

The governments of 14 countries in tropical America are participating with the Department of Agriculture in co-operative programs designed to stimulate the planting of rubber and the development and exchange of new and better planting material, according to Mr. Litchfield.

"What these nations want from us is guidance in developing such projects and assurance of markets," he continues. "We are clearly in position to give both guidance and assurance. With the United States purchasing a minimum of 150,000 tons of natural rubber annually, the dollar receipts of these countries would be substantially increased, thus making for higher standards of living there and establishing larger markets for exportable goods from this country."

Mr. Litchfield urges that the United States take the lead in the development of a hemispheric rubber policy among our friendly and anti-communistic Latin American neighbors. "Our own country's course in the matter of rubber policy has been erratic and short sighted. When a rubber crisis develops we spend lavishly and improvise wildly. When the crisis has eased, we pull back into our comfortable shell and do nothing. And we seem able to adduce countless reasons to justify our inaction.

"The time has come when we should mend our ways. It will take time, money and intelligent effort. But now we know we can make the effort pay off in terms of heightened security and permanent economic gain. The orderly rows of Hevea trees on our Costa Rican outpost have given us a sound foundation for action."

Goodyear's Costa Rica plantation was developed from rubber plant material taken from the company's plantation in the Philippines, which had been established from high yielding Sumatran stock prior to the ban on the export of such stock.

Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., is offering a technical bulletin on the uses of several Baker plasticizers with allyl starch. Formulations are given illustrating the efficient plasticization afforded by the use of the company products.

NATIONAL BUREAU OF STANDARDS PROMOTES McPHERSON AND KLINE

Dr. G. M. Kline

Dr. A. T. McPherson

Dr. A. T. McPherson, formerly chief of the Organic and Fibrous Materials Division of the National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C., has been named associate director of the Bureau. Dr. Gordon M. Kline, previously assistant chief of the division and chief of the Organic Plastics Section, has been appointed chief of the division succeeding Dr. McPherson. Dr. Kline will also remain as chief of the Plastics Section for the time being.

Dr. McPherson, a native of Marceline, Mo., received his B. A. from Trinity University and his M. S. from the University of Texas in 1916. He received a Ph. D. in chemistry from the University of Chicago in 1923. He came to the Bureau in 1918 and became chief of the Rubber Section in 1930. From 1943 until his most recent appointment, he served as chief of the Organic and Fibrous Materials Division, supervising NBS research in the fields of rubber, organic plastics, etc. The major part of his scientific work has been concerned with rubber research, including investigations of the electrical, optical, and thermodynamic properties of rubber and research in rubber technology.

Dr. Kline is internationally known for his researches in such fields as organic plastics, polymerization of olefins, dope for aircraft, and adhesives. He has been technical editor of *Modern Plastics* and the editorial director of the *Modern Plastics Encyclopedia* since 1936. Born in Trenton, N. J., Dr. Kline received his B. A. from Colgate University in 1925, his master's degree from George Washington University, and his doctorate from the University of Maryland in 1934. He joined NBS in 1929, and pioneered in the research on resins which led to the organization of the Organic Plastics Section under his direction in 1935. He serves as chairman of both the Federal Specifications Board Technical Committee on Plastics and ASTM Committee D-20 on Plastics. He is also the secretary of the Plastics and High Polymer Division of the International Union of Pure and Applied Chemistry.

RUBBER INDUSTRY HEADS SEE CAPACITY OPERATIONS DURING 1952

Rubber industry heads are in general agreement that the industry will operate near capacity in 1952 to meet the demand for civilian and defense products. H. E. Humphreys, Jr., president of the U. S. Rubber Co., in his year-end statement opined that industry sales should run about 6% ahead of the record-breaking 1951 total of $5,000,000,000. Mr. Humphreys stated that he does not expect a return of the scare buying which prevailed during part of 1951. Demand continues extremely high, he said, but the public's buying habits have returned to a more orderly pattern.

Inventories Being Rebuilt

The U. S. Rubber executive said that inventories of some products are still low, but they are being gradually rebuilt. The improvement in inventories, he asserted, will help to give the public better service in the coming year. He also stated that the aggregate of natural and synthetic rubber available to the United States will exceed our ability to consume it. Certain kinds of synthetic rubber are already in surplus supply and the government plans to sell it to foreign consumers. There is also a glut of natural latex.

Mr. Humphreys estimated total rubber consumption for the United States in 1952 at 1,336,000 tons, an increase of 8% over 1951. Of this total, approximately 65% will be synthetic. In his opinion, the rubber stockpile is now more than adequate for defense and the time has come for a completely free market in natural rubber.

It is expected that the industry will be able to fulfill all defense requirements. A large increase is expected in government orders for tires, rubber gasoline tanks and other products used in aircraft. Large-scale production is expected to continue on rubber treads for tank tracks. All indications point to a high level of employment in 1952, he said, with the prospect of manpower shortages in a few locations and some overtime operations.

Collyer Offers Opinion

John L. Collyer, president of the B. F. Goodrich Co., in his year-end statement, stated that the rubber industry's outlook for additional rubber supplies in 1952 is encouraging. Mr. Collyer estimated that from 1,200,000 to 1,300,000 tons of rubber, natural and synthetic, would be consumed during 1952 as a result of increased civilian and military requirements.

World production of synthetic rubbers, he said, about 95% of which is in the United States, is currently at a rate approaching 1,000,000 long tons a year and may soon exceed 1,100,000 tons annually. The total world output of natural and synthetic rubbers in 1952 should be about 2,900,000 long tons while world consumption is expected to be less than 2,500,000 long tons, thereby making available 400,000 long tons for addition to stocks in 1952.

Mr. Collyer asserted that we now have in the United States all the synthetic rubber that we can effectively consume in the manufacture of civilian and defense products. We have also built up stocks of sufficient size to permit government authorization for the export of some synthetic rubbers to friendly nations.

Litchfield Foresees Dangers

P. W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Co., while predicting that the rubber supply will increase in 1952, warned of the dangers of inflation in his year-end statement. Government, corporate and personal debt have reached dangerous proportions, he said, while the U. S. dollar has lost ground as a medium of exchange. Mounting federal taxes have discouraged corporate financing through new issues of equity stocks. Prices and wages have played leap frog with each other throughout the year and appear to be continuing the procedure as we enter 1952, he said.

Mr. Litchfield stated that looking forward into 1952 reveals mixed and dubious prospects. Some means must be found to arrest the inflationary trend; its momentum cannot be allowed to continue without inviting unpleasant economic consequences. And yet, he noted, with an election on our hands and the tensions of the world situation continuing unrelieved, corrective action on the inflation front may prove to call for more national courage than we are willing to exert. Thus, the underlying situation is not too pleasant.

In the rubber industry, business was exceptionally good during 1951, producing up to the limits of the available supply of raw materials. Rubber supplies will increase in 1952 so that there will be sufficient to meet all demands. However, with automotive production substantially reduced from the 1951 levels, it is evident that the manufacture of tires for original equipment will fall off while the replacement tire market is being stimulated by the demand of car owners who are driving 1949 and 1950 models, he stated.

With an ample supply of new raw rubber assured, said Mr. Litchfield, and with substantial modification of the government restrictions on its use, production of non-tire rubber items is likely to be considerably higher in 1952 than it was in 1951. Military demands will be higher than in 1951.

The over-all prospect, he said, is that the American rubber industry will process about 1,300,000 tons of new rubber in 1952, as against a somewhat lower total for 1951. In the absence of any sharp reversal of underlying inflationary pressures, 1952 will be a year of record employment and production in the rubber industry.

Foresees End of Controls

Harvey S. Firestone, Jr., chairman of the board of the Firestone Tire & Rubber Co., said in his year-end statement that the year 1952 may lead to the removal of some of the remaining government controls on use and manufacture of rubber providing the supply of plantation and synthetic rubber continues to increase and providing conditions in the Far East do not become more critical.

In 1952, he said, there will be on the road 3,000,000 more automobiles two or more years old than there were in 1951. Many of these vehicles will need new tires this year for the first time. This increased requirement for replacement tires will more than offset any anticipated decrease in requirements for tires for new automobiles.

Mr. Firestone said that the most important of our duties during the national emergency is to keep our transportation system rolling despite shortages of materials. In addition to this, he said, his company is tackling many new and difficult projects which call for development and production of equipment needed for military defense.

Looking at 1952 and beyond, W. O'Neil, president of the General Tire & Rubber Co., predicts a long-term demand for rubber products which makes the future loom bigger and brighter than ever for the industry. Mr. O'Neil stated that 1952 will see an even greater demand for quality products than was the case in 1951. He also sees a growing need for motor transportation as our metropolitan areas expand into the suburbs. The United States, he said, will become a nation of two-car families in the very near future. This can only mean a bigger demand for automobiles, more tires and tubes, and more rubber products.

Other Industry Comments

In his year-end summation of the scrap rubber market, Henry M. Rose, associated with H. Muehlstein, Inc., and president of the Scrap Rubber Institute of the National Association of Waste Material Dealers, Inc., pointed out that with tire factories scheduled to produce second-line tires in January, 1952, it may be expected that increased demand for tire reclaim will result. What 1952 may hold forth otherwise will depend a great deal on the availability of GR-S and the continuous supply of natural rubber.

Insofar as plastic-coated fabric and all plastic sheet is concerned, the Plastic Coating & Film Association predicts that the year 1952 will approximate 1951 in total shipments. This means that business and industry can anticipate the shipment in 1952 of about 63,000,000 linear yards of plastic-coated fabric (averaging 54 inches in width) and 60,000,000 square yards of all plastic sheet. Despite the general feeling in the industry that business has temporarily hit a plateau, at least half the companies engaged in plastic production have reported plans for the installation of new equipment in 1952.

Increased supplies of some types of plastic raw materials should be available in 1952 and shortages of other materials will continue, according to officials of the Bakelite Co., a division of the Union Carbide and Carbon Corp. A considerable portion of the expected increased supplies of raw plastics materials for 1952 are expected to be used for military production and military-supporting and essential civilian uses, according to a joint statement by George C. Miller and C. W. Blount, vice-presidents and general sales managers respectively, of the Thermoplas-

tics and Thermosetting Departments.

Mr. Miller estimates the industry's production of polyvinyl chloride type materials will probably be at a 1952 rate of from 400,000,000 to 425,000,000 pounds, which will be somewhat higher than the 1951 total output. Polyethylene in 1952 will be produced at a top capacity of 75,000,000 to 80,000,000 pounds as compared with about 65,000,000 in 1951.

William T. Cruse, executive vice-president of the Society of the Plastics Industry, Inc., also foresaw an increase in plastics material supplies. This is due, in part, to a betterment in the supply of benzene and styrene. The year 1952, he said, will see more new plants for the production of plastics raw materials. Mr. Cruse predicted a normal supply situation for the manufacture of vinyls.

Chemical Industry Outlook

Federal taxation and the increasing shortage of skilled manpower are serious threats to the continuing progress of the chemical industry, said W. S. Richardson, vice-president of the B. F. Goodrich Co. Mr. Richardson, in his statement, advocated a five-year amortization plan for new facilities in the chemical industry and the diligent use of all existing incentives to induce more college students to become candidates for degrees in engineering and the sciences.

Monsanto Italian Resin Plant

Integrated facilities for the production of polyvinyl chloride resins and compounds of the Ultron 300-type manufactured by the Monsanto Chemical Co. in the United States are under construction at Porto Marghera, Italy, by Societa Industria Chimica, an Italian company in which Monsanto holds an interest. Monsanto officials have disclosed that a chlorine-caustic plant employing De Nora mercury cells has already been put into operation. Acetylene for producing vinyl chloride monomer will be made from calcium carbide from a nearby plant in which Societa Edison, major power company of Italy, has an interest. Societa Industria Chimica is a subsidiary of Edison. The polymerization plant, also being built at Porto Marghera, will be the largest of its kind in Italy.

New Acetylene Derivative Available

PVM/MA, a new polymeric acid anhydride, which is soluble both in water and in organic solvents, and which has properties suggesting its use in adhesives and latex, as well as a wide range of other products, is currently available in pilot plant quantities from the Product Development Department, General Aniline & Film Corp., Easton, Penna. Structurally, the new acetylene derivative is a linear copolymer consisting of alternating methyl vinyl ether and maleic anhydride units. It is a fluffy, white, amorphous powder in appearance and is compatible with a wide variety of water-soluble gums and resins and plasticizers. A technical bulletin describing PVM/MA is available from the company on request.

Recording Process Uses Hycar

Sound recording in conjunction with film-making has been simplified by means of a magnetic stripe applied to the film, either before or after processing, and a prototype camera produced by RCA. The magnetically striped film, called Magna-Stripe and manufactured by the Reeves Soundcraft Corp., New York, N. Y., is made whereby a stripe of magnetic oxide is placed on the base side of motion picture film. Hycar is used as the magnetic oxide pigment binder on the cellulose Magna-Stripe. A microscopic film of rubber covers each of the uniform-sized particles of oxide, preventing any abrasive material from touching the magnetic heads. Hycar PA is used as the pigment binder because of its good adhesion to cellulose acetate, its inherent stability, and because it does not interfere with electrical response and does not permit the strip to become hard and brittle.

Named Director of Purchases

Mark W. Laibe, formerly a division manager in the Purchasing Department of the Goodyear Tire & Rubber Co., has been named director of purchases for the firm, succeeding E. H. Brooks, who retired on January 1. Coincident with Mr. Laibe's promotion, Rollin D. Chittenden, previously manager of another division within the purchasing department, was appointed purchasing agent. The latter position had been unfilled since the death of George Price, former purchasing agent, in 1947. Mr. Laibe joined Goodyear in 1925 in purchasing, following his graduation from Ohio State University. Mr. Chittenden was graduated from the University of Denver and also attended the School of Commerce of Northwestern University. He has been associated with Goodyear since 1920. Mr. Brooks joined the company in 1909 as a cost clerk. He was named director of purchases in 1937, a position he held until his retirement.

Ruhr Firm Resumes Output

The Huels Chemical Works in Western Germany has disclosed that production of synthetic rubber was scheduled to begin this month. The Allies stopped production in June, 1948, and authorized resumption of synthetic rubber manufacture in April, 1951. Initial output is expected to be 500 tons of butadiene monthly, of which 400 tons will be used for processing buna, the German company stated. Future plans call for 2,000 tons a month, with the firm hoping to export a part of this sum. Total West German synthetic rubber consumption is estimated at 60,000 to 80,000 tons annually.

Cabot Research Appointments

Godfrey L. Cabot, Inc., Boston, Mass., has announced a series of appointments to its Research and Development Department at Boston and to its Development Division at Pampa, Texas. Dr. B. B. S. T. Boonstra, formerly chief of the technical laboratory at Delft, Holland, has joined the Boston staff as head of the Rubber Research Group. E. M. Dannenberg continues in charge of the Applications Research and Technical Service Division, which includes responsibility for research on rubber and plastics. James C. MacKenzie has been chosen to lead the Organic Research Group, which is devoted particularly to the development of plasticizers. Mr. MacKenzie, a graduate of Toronto University, comes to Cabot from the Central Research Laboratories of Canadian Industries, Ltd., McMasterville, Que. R. E. Dobbin, formerly head of the Applied Research Section in Boston, has been appointed assistant director of the Development Division at Pampa. He replaces N. D. Steele, who is now assistant to the production manager, and is replaced in Boston by R. N. Secord, a research engineer with Cabot for the past five years. Other new appointees to the Boston Research and Development Department include R. D. Beattie, formerly with the Dewey and Almy Chemical Co.; T. E. Billington, formerly with Koppers Co., and K. A. Loftman. Mr. Billington and Mr. Loftman both worked at the Cabot Laboratories while studying at Northeastern University under the cooperative plan.

Expanding Flexol Production

Carbide and Carbon Chemicals Co., a division of the Union Carbide and Carbon Corp., is planning to expand facilities at its South Charleston, West Va., plant for the production of "Flexol" plasticizer TOF. Chemically, the product is a tri (2-ethlyhexyl) phosphate. It finds use in many types of synthetic rubber and plastic products essential for defense purposes. Construction of a new unit, for which an NPA Certificate of Necessity has been granted, will get under way as soon as necessary materials have been obtained. It is expected that production will begin before the latter part of 1952. The new unit will more than double the present capacity for the plasticizer at the South Charleston plant. Production from the new unit will be used 100% for national defense purposes.

Emery C-842-R Stearone

Emery Industries, Inc., Cincinnati, Ohio, has announced the availability of Emery C-842-R Stearone in experimental quantities. The product is a white, crystalline solid, with a melting point of approximately 75° C. It is insoluble in water and only slightly soluble in hot alcohol or ether. The wax-like character of Stearone suggests its use as a wax or wax extender. A descriptive bulletin and an experimental sample are available on request from the company. Address Emery Industries, Inc., Department 5, Carew Tower, Cincinnati 2, Ohio.

NAMES IN THE NEWS

G. R. Monkhouse, associated with the Shell Oil Co. and its affiliated companies for the past 30 years, has been named vice-president in charge of the Western Division of the Shell Chemical Corp., with headquarters in San Francisco, Calif.

Petrus W. Meyeringh, a vice-president, director and member of the Executive Committee of the Hercules Powder Co., has retired from his position with the organization for reasons of health.

Carlton H. Gilbert, associated with the U. S. Rubber Co. since 1934, has been named to the newly-created position of advertising manager of the company.

Arthur W. McGuire, formerly associated with the Chicago Metal Hose Co., has been named assistant sales manager of the Arrowhead Rubber Co., Downey, Calif.

Dr. Farrington Daniels, professor of chemistry at the University of Wisconsin, has been named president-elect of the American Chemical Society for 1953.

Gregg T. Ward, associated with the U. S. Rubber Co. since 1925, has been appointed general sales manager of the Footwear and General Products Division of the company.

F. Thatcher Lane, president of the Seamless Rubber Co., has been elected a director of the McBee Co., manufacturers of accounting and statistical equipment.

Harry M. Brubaker, formerly associated with Goodrich, Phillips Chemical and Sid Richardson Carbon, has been appointed assistant sales manager of the Carbon Black Division of the Witco Chemical Co.

William I. Burt, president of the B. F. Goodrich Chemical Co., has been elected president of the American Institute of Chemical Engineers for 1952.

Robert Lansing Campbell, associated with the Chicago, Ill., staff of the New Jersey Zinc Sales Co., has been transferred from the Pigment Sales Division to the Metal Sales Division.

Roger G. Bossen, formerly technical manager at the Tuscaloosa, Ala., plant of the B. F. Goodrich Co., was recently transferred to Akron as technical coordinator for all the company's domestic tire plants.

M. Rex Paul, formerly associated with Frederic H. Rahr, Inc., New York, N. Y., has been appointed a vice-president of the Eagle-Picher Sales Co., Cincinnati, Ohio, and will head the firm's Washington, D. C., office and direct its government contracts.

Henry N. Lyons, formerly associated with the Devoe & Reynolds Co., has been appointed manager of technical service by the Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

Maurycy Bloch, previously sales manager of the Warwick Wax Co., a subsidiary of the Sun Chemical Corp., Long Island City 1, N. Y., has been named vice-president of Warwick. He will continue to direct sales activities for the company.

Walter J. Beasten, associated with E. I. du Pont de Nemours & Co., Inc., since 1924, has been named New York branch manager of the Pigments Department, succeeding Lloyd Kelly, who is retiring on February 1 after more than 30 years' service with the company.

Robert H. Kilgore, formerly assistant manager of the Films and Flooring Division of the Goodyear Tire & Rubber Co., has been named manager of field sales for the company.

James E. MacDonald, Jr., vice-president of the Goodall Rubber Co., Trenton, N. J., has accepted the chairmanship of the Rubber Division in the current polio appeal of the National Foundation for Infantile Paralysis in Greater New York.

Carl Totsch, previously assistant sales manager of the Midwest Rubber Reclaiming Co., East St. Louis, Ill., has been promoted to sales manager of the company.

Alvin F. Buchanan, associated with the U. S. Rubber Co. for the past 26 years, has been appointed advertising manager of the Footwear and General Products Division of the company.

Harry T. Jackson, formerly branch manager of the Pioneer Rubber Mills at Los Angeles, Calif., has been named assistant general sales manager. William S. Long, in the rubber industry for the past 32 years, has been named to succeed Mr. Jackson at Los Angeles.

Ralph T. Nazzaro, until recently associated with Texon, Inc., as director of research and development, has joined the Westfield River Paper Co., Russell, Mass., in a similar capacity.

J. W. Adams, formerly associated with the synthetic rubber research section of the U. S. Rubber Co., is now a member of the central research division of the Marathon Corp. at Rothschild, Wisconsin.

Winton L. Slade, previously associated with the Fremont Rubber Co., has been named a section head in the Research and Development Department of the United States Asbestos Division of Raybestos-Manhattan, Inc., Manheim, Penna.

Philip T. Sharples, chairman of the board and former president of the Sharples Corp. and Sharples Chemicals Inc., has been elected to the board of directors of the Pennsylvania Salt Mfg. Co.

George H. Pendleton, since 1936 manager of government sales for the Mechanical Goods Division of the U. S. Rubber Co., retired on December 31, after 46 years of service with the company.

Frank W. Knowlton, assistant secretary of the General Tire & Rubber Co. since 1940, has been named chief legal counsel of the company succeeding Hayes R. Jenkins, who has been granted an extended leave of absence due to ill health.

Robert Scholes, associated with the Fidelity Machine Co., Inc., Philadelphia, Penna., for the past 13 years, has been named vice-president in charge of engineering.

Frank S. Malm and his wife left for Germany on January 5, where he will represent the Radiation Division of the United States Naval Research Laboratories as engineer-general on a coaxial cable project.

J. A. Johansen, vice-president of the Baker Castor Oil Co., and Daniel R. Finn, treasurer, have been elected to the board of directors of the company.

S. A. Smith, Jr. has been elected as treasurer of the General Cable Corp., while Ralph W. Atkinson has been named director of research. Both executives have been with the company for some years.

Alvin A. Kent has been appointed plant engineer and John Sikeritzky has been named assistant plant engineer for the Seamless Rubber Co., New Haven, Conn.

H. M. Sossaman, formerly general sales manager of the Quaker Rubber Corp., a division of the H. K. Porter Co., has been named vice-president in charge of commercial development for the rubber company. J. R. Lewis succeeds Mr. Sossaman as general sales manager of Quaker Rubber.

James P. Drury, formerly general foreman of the Curing Division of the Seiberling Rubber Co., has been named manager of production control for the company.

Albert E. Forster, associated with the Hercules Powder Co. since 1925, has been elected a vice-president and a member of the Executive Committee of the company.

William E. Bradford, associated with the U. S. Rubber Co. since 1914, has been named coordinator of industrial relations for the Naugatuck Chemical Division of the company.

Charles M. Hellyer, presently a vice-president of the H. N. Richards Co., has also been named general manager of the company.

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NEW POLYMERS AUTHORIZED BY SYNTHETIC RUBBER DIVISION, RECONSTRUCTION FINANCE CORPORATION

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Synthetic Rubber Division, Reconstruction Finance Corporation, since publication of those in our previous issue. Procedures for the distribution and sale of these polymers will be found in our October, 1945, issue. Normally, experimental polymers will be produced only at the request of the consumers and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside if possible for distribution to other interested companies for their evaluation. The 20 bales when available will be distributed in quantities of one or two bales upon request to the Synthetic Rubber Sales Division or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received to warrant them.

X No.	*Polymer Description*	*Remarks*
X-691 GR-S	A masterbatch of 40 parts of naphthenic processing oil (Circosol-2XH), 77 parts of HAF black (Philblack O), and 100 parts of base polymer. The base polymer is identical with GR-S-101 except the reactor Mooney viscosity is 125 ML-4. Stabilizer is 1.25% BLE on the polymer. The oil is emulsified with oleic acid, and the oil emulsion and carbon black slurry are premixed prior to coprecipitation with latex.	This oil-extended carbon black masterbatch is formulated in such a way that a fatty acid (oleic) will be present in the finished product in the amount of 1 part/100 parts of polymer. In the pilot plant, the technique of premixing oil emulsion and carbon black slurry prior to coprecipitation with latex has resulted in lower than usual compounded viscosity. This may indicate slightly improved processing. The higher carbon black loading (77 parts vs. normal 50 parts) should give improved physical properties.
X-692 GR-S	A masterbatch of 40 parts of naphthenic processing oil (Circosol-2XH) and 100 parts of the base polymer in X-691-GR-S.	This oil-rubber masterbatch is designed as a control polymer to determine the influence of carbon black in the evaluation of X-691-GR-S. In applications where the presence of some fatty acid is desirable in compounding, this experimental polymer may be useful since it is designed to contain approximately 1 part of a fatty acid (oleic) per 100 parts of polymer.
X-693 GR-S	A masterbatch of 25 parts of naphthenic processing oil (Circosol-2XH) and 100 parts of a base polymer. The base polymer, containing approximately 20% bound styrene, is polymerized at 41° F. in the iron-pyrophosphate, organic hydroperoxide activated system. The emulsifier is a 50/50 mixture of rosin acid and fatty acid soaps, and the shortstop is sodium dimethyldithiocarbamate plus adjunct (sulfur or polyamine). The oil-rubber masterbatch is stabilized with 1.25% Wingstay S on the polymer. Raw Mooney viscosity of the masterbatch is approximately 65 ML-4.	X-693 is intended to be a non-staining, non-discoloring oil-rubber masterbatch for general purpose use. It is designed to provide an oil-rubber masterbatch for use in those applications where staining and discoloration are problems. Except for the substitution of a non-staining antioxidant (Wingstay S), this masterbatch is identical with X-628-GR-S (a general purpose oil-cold rubber masterbatch).
	Please Note Changes Made in the Following Polymer Descriptions	
X-663 GR-S	Shortstopped with sodium dimethyldithiocarbamate plus adjunct (sulfur or polyamine).	The base polymer in X-663-GR-S is polymerized in the sugar-free formula with dinitrochlorbenzene as the shortstop. Since it has been found that dinitrochlorbenzene in the absence of sugar may induce dermatitis, the shortstop sodium dimethyldithiocarbamate, generally considered non-toxic, has been substituted for dinitrochlorbenzene.

NOTE: The above new polymers are experimental only and the Synthetic Rubber Division, Reconstruction Finance Corporation, does not make any representation or warranties of any kind, express or implied, as to the specifications or properties of such experimental polymers, or the results to be obtained from their use.

Sundex 41 Processing Aid

Sun Oil Co., Philadelphia 3, Penna., has announced the development of Sundex 41, a new processing aid for cold rubber. When properly applied in the production of stocks from cold GR-S, it is said that Sundex 41 will help prevent scorching during mixing, milling, and extruding. It will also aid dispersion of compounding ingredients, the company states, and contributes to improved wear resistance, flex life and reduces power consumption. The product is especially useful in the production of tread stocks and similar rubber compounds. It is free-flowing at any temperature likely to be encountered and has no detectable bad effects on finished products.

New American Polymer Thickeners

American Polymer Corp., Peabody, Mass., has announced the development of Polyco 296BT and Polyco 296N, aqueous solutions of sodium polyacrylate. They are water-soluble anionic colloids furnished as straw-colored, homogeneous solutions containing 15% solids. Polyco 296BT is a high-viscosity grade and Polyco 296N is a medium-viscosity grade. These acrylic thickeners are recommended by the company primarily as stabilizers, protective colloids and thickeners for natural, synthetic rubber and resin latices. They are said to possess unique adhesive, suspending, emulsifying and film-forming characteristics which suggest many other industrial uses.

Welding Guns for Thermoplastics

Two types of welding guns designed for hot gas welding of thermoplastic materials are now available through the Plastics Division of the American Agile Corp., Bedford, Ohio. The two standard types of guns for welding of thermoplastics are a gas-heated and an electrically-heated type. Both types operate on an identical principle, i.e., a stream of inert gas such as nitrogen or compressed air which is passed through a heating element at low pressure and leaves the welding gun through the nozzle. The temperature of the welding gas stream leaving the gun can be varied from 300 to 700° F. Complete operating and welding instructions are furnished with each unit.

NBS SPONSORS SYMPOSIUM ON POLYMER DEGRADATION MECHANISMS

The mechanisms of polymer degradation were the subject of a symposium held at the National Bureau of Standards on September 24, 25, and 26, 1951. This was the eighth of a series of 12 symposia scheduled for the year 1951, which marked the fiftieth anniversary of the Bureau's establishment. Sponsored by NBS in cooperation with the Office of Naval Research, the meeting brought together approximately 200 scientists from this country and abroad who are engaged in theoretical and experimental studies of the manner in which plastics break down on exposure to light, heat, moisture, and other deteriorating influences. Seventeen technical papers were presented by representatives of government, industry, and the universities.

Research on the durability of polymeric materials is becoming increasingly important as these materials take on new uses and find application in national defense. A knowledge of the mechanisms by which polymers degrade is needed in order to predict more accurately their expected service life, to inhibit degradation more effectively, and to devise better methods of accelerated testing. Among the plastics discussed at the symposium were nylon, saran, polyvinyl chloride, polyacrylonitrile, polyethylene, polystyrene, and the cellulose esters and others. Although these materials show a high degree of stability and last much longer in most applications than the natural products which they have replaced, a better understanding of how and why they fail should lead to an even greater degree of permanence, the Bureau stated.

Fundamental Degradation Theories

The first session, under the chairmanship of Dr. G. M. Kline (NBS), was concerned with the fundamental theories of degradation. Dr. H. H. G. Jellinek (University of Adelaide, Adelaide, Australia) presented his theories of random degradation, weak link, and preferential degradation from chain ends involving initiation, propagation, and termination steps. Dr. R. Simha showed that the photochemical and pyrolytic degradation of vinyl polymers is a complicated process which cannot in general be described by a theory of random breaking of links. Since free radicals are involved, it is natural to treat these reactions as the reverse of an addition polymerization, that is, as chain reactions. The simplest mechanism consists of an initiation of free radicals, followed by propagation, transfer, and termination steps. Dr. Simha pointed out that two parameters are important: the kinetic chain length and the probabilities of transfer and initiation.

A paper on "The Photochemical Degradation of Polymethyl Methacrylate," by P. R. Cowley and Professor H. W. Melville of the University of Birmingham, Birmingham, England, was read to the group by A. R. Burgess (Imperial Chemical Industries). It was shown that polymethyl methacrylate degrades rapidly to the monomer when irradiated with ultraviolet light of wavelength 2537 Å *in vacuo* at temperatures above 130° C. The degradation is a true depolymerization process involving initiation, propagation, and mutual termination. Information on the degradation of this polymer is of special value inasmuch as it is one of the most stable polymeric materials, Mr. Burgess opined.

Polyvinyl Chloride Polymers

The second and third sessions dealt with the degradation of polyvinyl chloride-type polymers. Papers on "The Effect of Heat and Light on Polyvinyl Chloride," by D. Druesedow and Dr. C. F. Gibbs (Goodrich Chemical), and "The Photodegradation of Polyvinyl Chloride," by Dr. A. S. Kenyon (Monsanto), were presented at the second session which was under the chairmanship of Dr. B. S. Biggs (Bell Telephone Laboratories).

Dr. J. B. Nichols (DuPont) was chairman of the third session. A. L. Scarbrough, W. L. Kellner, and P. W. Rizzo (National Lead) reported on "The Role of Hydrogen Chloride in Polyvinyl Chloride Degradation," and C. B. Havens (Dow Chemical) discussed the "Aging of Vinyl Chloride and Vinylidene Chloride Polymers." Loss of hydrogen chloride occurs during degradation of these polymers and must be inhibited; however, the initiation mechanism is not yet clearly defined. Work on polyvinyl chloride at NBS, reported in the discussion period by B. G. Achhammer (NBS), suggests that the initiation step is caused by the breakdown of hydroperoxide in the polymer and that the correlation usually drawn between loss of hydrogen chloride and discoloration of the polymer is questionable.

In a paper by Dr. J. R. McCartney (DuPont), polyacrylonitrile was reported to undergo rapid and large molecular weight degradation on addition of dilute alkali to its solutions. Application of the theoretical considerations of Montroll and of Simha to this work suggests that the reaction mechanism is a random chain scission of the normal head-to-tail polymer linkages.

Oxidation of Polyethylene

The mechanism of oxidation of polyethylene and its stabilization was described in the fourth session which was under the chairmanship of C. R. Stock (American Cyanamid). Dr. B. S. Biggs (Bell Telephone Laboratories) discussed "Studies on the Oxidation of Polyethylene," and Dr. A. R. Burgess (Imperial Chemical Industries) described the "Photooxidation and Stabilization of Polyethylene." The susceptibility of this polymer to photooxidation when unprotected makes its useful life in outdoor exposure very short. However, light-absorbing pigments, such as carbon black, increase the life of the material by as much as 10 years or more. Professor J. R. Shelton (Case Institute) showed that the rate of oxidation of phenyl-substituted olefins is a function of the concentrations of peroxide and unreacted olefin. Oxidation at the alpha methylene group is indicated, although some initial attack at the point of unsaturation also seems probable.

The fifth session, of which Dr. R. B. Mesrobian (Polytechnic Institute of Brooklyn) was chairman, consisted of two papers on the "Breakdown in Cellulose Ester Systems by Heat and Light," by G. C. DeCroes and Dr. I. W. Tamblyn (Tennessee Eastman), and the "Oxidative Degradation of Ethyl Cellulose," by Dr. L. F. McBurney (Hercules Powder). Emphasis was placed on the oxidation mechanisms of the cellulosic polymers. Apparently the primary attack by oxygen forms hydroperoxide and the secondary reactions, such as those causing a drop in viscosity, result from the hydroperoxide decomposition.

The final session, under the chairmanship of Dr. Warren Stubblebine (Office of the Quartermaster General), summed up the research on degradation mechanisms at NBS. Dr. S. L. Madorsky (NBS) discussed the rates of thermal degradation of polystyrene and polyethylene that were obtained by measuring the loss in weight of samples by means of a very sensitive tungsten spring balance enclosed in a vacuum. Rate curves plotted against percent degradation indicate that in the case of polystyrene the process is intermediate between a zero- and a first-order reaction, while in the case of polyethylene, the process resembles a first-order reaction. Activation energies were calculated on the basis of rates of degradation at various temperatures.

Pyrolysis of Copolymers

Dr. L. A. Wall (NBS) described the pyrolysis of copolymers. Studies on styrene-butadiene, styrene-isoprene, and methyl methacrylate-isoprene copolymers led to the derivation of expressions relating the yield of each species to its value from the simple polymer, to the copolymer composition, and to the reactivity ratios of the monomers involved in the preparation of the copolymer. The relationships derived are applicable to any process occurring at the boundaries of the sequences and may be useful in studies of other types of degradation.

Since 1946, the Office of the Quartermaster General has supported an NBS project on the mechanism of polymer degradation. Two phases of this work were reported during the final session. B. G. Achhammer (NBS) discussed the degradation of polystyrene by heat and ultraviolet radiant energy. The importance of hydroperoxide, which is assumed to be the result of primary attack on the polymer by oxygen, was demonstrated. The results of this work show that the degradation of polystyrene involves two different processes: (1) the breakdown of thermolabile groups formed in the polymer prior to degradative treatment (this is caused by exposure both to heat and to ultra-violent radiant energy at 120° C. and is accompanied by the removal of residual materials such as solvent), and (2) the oxidation of the polymer (caused by exposure to ultraviolet radiant energy in the presence of oxygen at 120° C.).

The mechanism of the degradation of

polyamides was reported by F. W. Reinhart (NBS) as consisting of the following steps: (1) breaking of the polymer molecules at the C-N bond of the peptide group; (2) changes in the degree of crystallinity or local order; (3) changes in the amount of strongly bound water, organic liquids or both.

The most striking aspect of the conference was the progress that appears to have been made over the past few years in elucidating the structure of polymers and the mechanisms of their breakdown. The insight thus provided into the fundamentals of the degradation reactions should aid materially in the solution of some of the problems of polymer degradation in the near future. To make the results reported at the symposium generally available to workers in the field, NBS plans to publish the proceedings together with discussions and submitted comments.

Mold-Ease Concentrate PCR

Merix Chemical Co., 1021 East 55th St., Chicago 15, Ill., has developed Mold-Ease Concentrate PCR, a new, powerful and water-soluble mold lubricant which is said to assure quick release of molded rubber, plastic and ceramic articles. The product may be sprayed or wiped onto casts or molds and may be used with either natural or synthetic rubber. For use with rubber, the concentration is usually 1 part of the product to seven parts water. The company states that unlike oily lubricants, there is no oil-spotting and the finish of the molded product becomes enhanced. Also, molds are said to live longer when using the product because there is hardly any carbonaceous residue since Mold-Ease Concentrate PCR burns up nearly 100%.

To Head Arco Rubber Division

As reported in a recent issue, the Automotive Rubber Co. of Detroit, Mich., has formed the Arco Rubber Processors Division at Houston, Texas, taking over a plant previously operated by the Texas Tank Co. It has now been announced that R. P. Ganchan has been appointed to head activities of the new division. In his new capacity, Mr. Ganchan will have complete charge of the manufacturing and sales activities of the new operation. Arco Rubber Processors Division will specialize in engineering, manufacture and installation of rubber insulated tanks, tank cars, exhaust systems, pipes and other goods.

Emery A-805-R Stearanilide

Emery Industries, Cincinnati, Ohio, has announced the availability of a new development product, Emery A-805-R Stearanilide, in experimental quantities. The product is a hard, odorless waxy solid which shows promise as a wax or wax extender for coatings, etc. At higher temperatures, solubility in solvents increases, and upon cooling, its unusual ability to hold large quantities of solvent results in the formation of a gel. Experimental samples and literature are available from the company.

Norris Named Division Manager

E. A. Norris

E. A. Norris, formerly plant manager of the Port Clinton (Ohio) Division of the Standard Products Co., Cleveland, Ohio, has been named division manager. One of Mr. Norris' duties will be to complete the conversion of the Port Clinton Division into a modern and efficient mechanical rubber plant and to supervise production of $6,000,000 in tank track orders. A program to improve the mechanical rubber facilities of the division is already well under way. To provide space needed for tank track work and other mechanical rubber business, window channel production activities formerly carried on at Port Clinton are being transferred to other Standard Products plants at Lexington, Ky., Gaylord, Mich., and Long Beach, Calif. Mr. Norris, who joined Standard Products in 1948, succeeds L. S. Larson, former general manager who has been transferred to the company's administrative offices in Cleveland in an administrative capacity under the vice-president in charge of finance. A graduate of the Massachusetts Institute of Technology, Mr. Norris was formerly factory manager for the Acushnet Process Co., and for the Sun Rubber Co.

Rubber Engraving Facilities

Pearl Engraving Corp., 36 West 29th Street, New York, N. Y., has announced the completion of new facilities for the engraving of hard rubber, plastics or metals to specifications. Pearl Engraving is now equipped to do raised or sunk lettering, straight or reverse, and pantographing in any style, size or color for identification plates, scales, switchboard panels, dials, trademark plates, directional indicators, wiring diagrams, etc. Equipment is also available to do all drilling, beveling and tumbling operations.

Naugatuck Chemical has announced the development of Vibrin X-1047, a new polyester laminating resin which will withstand temperatures as high as 500° F., and which is expected to find its most significant use as a structural material in the manufacture of high-speed aircraft and guided missiles.

German Rubber-Felt Boot Offered

G. Huchler, K.G., Filz-u. Filzwarenfabrik, Biberach, a.d. Rib, (Wurtt.), Germany, has developed a new type of rubber-felt boot suitable for both military and civilian uses. A feature of the boot is an anatomically fitted felt innersole, 10 mm thick. Felt and rubber are worked to one fitting form without being sewn or glued together. The construction of the boot allows the felt or rubber to be changed at any time. The boot is light in weight and has a non-skid sole. It is said to provide full protection against all types of weather. The firm is interested in marketing either the entire boot in the United States on a royalty basis, or in selling the felt innersoles to American manufacturers of rubber boots. The firm may be contacted at the above address.

Softseam Foam Rubber Adhesive

Anchor Adhesives Corp., 36-23 164th St., Flushing, N. Y., has developed "Softseam," a new adhesive for fabricating foam rubber. The product is said to be an improvement over other adhesives because the seam formed by the cemented surfaces remains soft. It is easy to apply and has immediate grab. "Softseam" cures quickly and has no depression tack after four hours, the company states. The product does not require any mixing. The use of "Softseam" is said to make possible the fabrication of intricate shapes from foam rubber for use in pillows, mattresses, upholstered chairs, toys, etc., A booklet showing how to fabricate foam rubber with "Softseam" is available upon request to Anchor Adhesives.

Establishes Research Department

The Kentucky Synthetic Rubber Corp. has established a Research and Development Department with a program directed toward the development of new synthetic rubbers for non-tire uses. A pilot plant, situated at the government-owned synthetic rubber unit at Louisville, Ky., has been reactivated and equipped for polymerization at low temperatures. The research project is sponsored by the Reconstruction Finance Corp. Dr. N. R. Legge, formerly leader of the Physical Research Laboratory of the Polymer Corp., Sarnia, Ontario, Canada, has been appointed director of the new Research and Development Department.

G-E Expanding Silicone Production

The Chemical Department of the General Electric Co. has announced an expansion program of over $5,000,000 to increase the production capacity of its silicone plant at Waterford, N. Y. The Waterford plant, located on a 65-acre site, is now producing silicone rubbers, fluids, greases, resins and water repellents. Additional manufacturing facilities are now being installed and it is planned that the new facilities will be operating by the end of 1952. Plant employment is expected to be increased by 50% and the laboratory staff doubled.

SOVIET SYNTHETIC PRODUCTION ESTABLISHES NEW HIGH IN 1951

Production of synthetic rubber in the Soviet Union in 1951 reached a new record of between 250,000 and 300,000 metric tons (275,575 and 330,690 tons), close students of the Soviet chemical industry believe, according to an article in a recent issue of the *New York Times*.

Production of 300,000 metric tons is estimated by P. Vinokurov, a refugee Russian scholar, who has recently published a comprehensive examination of the Soviet chemical situation. A somewhat lower figure of around 250,000 metric tons is accepted by Department of Commerce observers, who agree that Soviet synthetic rubber output is being pushed vigorously and is rising well above earlier marks.

Despite the increasing domestic synthetic output, the Soviet Union is still seriously dependent upon natural rubber. Soviet consumption of natural rubber in recent years has been authoritatively estimated at about 100,000 tons annually, obtained by extensive purchases in Southeast Asia. Natural rubber is mixed with synthetic rubber to obtain the best results in many important uses, particularly in the manufacture of automobile and truck tires.

Soviet concern that supplies of natural rubber may be withheld by international commodity allocation agreements is believed to have been a major factor behind the large-scale trade offer presented by Soviet delegates at the recent Asiatic economic conference in Singapore.

Available indications point to the conclusion that Soviet efforts to develop a major domestic source of natural rubber from extensive cultivation of kok-sagyz, the Russian dandelion, have produced disappointing results. Low yields and farmers' reluctance to produce this crop have been indicated in Soviet press comment. There has been some evidence recently that disappointment with results from kok-sagyz has caused Soviet specialists to turn to the Mexican guayule plant as an alternative source.

The Soviet Union is at present apparently producing both buna and neoprene type synthetic rubbers. During the period of United States-Soviet technical cooperation during World War II, American experts found that Soviet output then was almost entirely that of "unimproved" buna rubber. With the United States Government's approval, the Soviet Government then received permission and the information needed to produce neoprene type rubber, the output of which has since been greatly expanded.

West Germany Producing Buna N

Following the arrival of butadiene from the chemical works in Huels, Germany, Farbenfabriken Bayer at Leverkusen has resumed production of Buna N. Initial output is estimated at 500 tons monthly and it is expected that production will reach 2,000 tons a month in 1952. The acrylonitrile being used is made at the Bayer factory by a new process developed during World War II. The Bayer works, it is said, has the only installation of its kind in West Germany.

Goodrich Announces Appointments

B. F. Goodrich Co. has announced several appointments in its Tire Manufacturing Division. Fred N. Lehmann has been named staff superintendent and George S. Ketter manager of industrial engineering for the division. Mr. Lehmann had been production superintendent at the company's Oaks, Penna., plant for the last three years. Warwick McCutcheon succeeds him in the post at Oaks. Mr. McCutcheon had been manager of industrial engineering in the division for the last two years. Gordon W. Anderson has been appointed production superintendent at the Tuscaloosa, Ala., plant. He had been manager of industrial engineering at the Miami, Okla., plant for seven years. Succeeding him in that post is George J. Kromja, Jr. Mr. Lehmann has been with Goodrich for the past 11 years. He is a graduate of the Carnegie Institute of Technology. Mr. Ketter has been with the company for the past 5 years and is a graduate of the University of Cincinnati. Mr. McCutcheon, with a degree from Cornell University, has been with Goodrich for 6 years. Mr. Kromja has been with the company for 5 years and is a graduate of the University of Pennsylvania.

Phillips Acquires Alamo Stock

Phillips Petroleum Co. has acquired all interests in the Alamo Chemical Co. previously held by the Borden Co. and the General Aniline & Film Corp. Earlier reports indicated that there had been preliminary discussions among the stockholder corporations relating to construction of manufacturing facilities by a jointly-owned organization. Phillips Chemical Co., wholly-owned subsidiary of Phillips Petroleum, is starting construction immediately on the large plant which Alamo had projected for producing ammonia, methanol, and other chemicals made from petroleum raw materials. The new plant will be located on a 500-acre tract of land adjoining the present 340-acre site of Phillips Chemical's ammonium sulfate plant at Adams Terminal on the Houston Ship Canal in Texas. The new facilities are expected to serve as a basis for the future manufacture of a wide variety of petrochemicals.

Bridgwater Building New Plant

Bridgwater Machine Co., Akron, Ohio, is constructing a new plant just over the eastern limits of the city. The brick and steel factory is being erected on a 10-acre site at an estimated cost of $235,000. When completed, the structure will measure 120 by 200 feet and provide 24,000 square feet of floor space. The enlarged facilities are required in connection with the increased demand for two major types of products, both vital to the defense program, company officials stated. Decision to build the plant was seen as part of the company's consolidation program. Eventually, the company is expected to merge all its operations under one roof. The new site provides ample room for future expansion.

GOVERNMENT PLACES CEILING ON TIRE INDUSTRY DISCOUNTS

The Federal Trade Commission, on January 3, put a ceiling on tire industry discounts in a move to reduce "monopolistic conditions" in the industry. FTC ruled that, starting April 7, no tire maker may give discounts or lower prices on any single shipments of more than a carload. This covers both tires and tubes sold as replacements for all kinds of motor vehicles.

A four-to-one FTC majority, headed by Chairman James M. Mead, said that without the limit it was relatively certain monopolistic conditions in the replacement tire industry "will continue and worsen." Commissioner Lowell B. Mason, in a dissent, said the facts did not justify the ruling which he termed "improvident and arbitrary" and a violation of the commission's legal powers.

The new rule is designed to assure smaller tire dealers the same discounts available to large sellers and thus prevent preferential treatment that might promote monopoly.

U. S. Rubber Co. has announced that it will fight this attempt of the FTC to determine the prices their customers will pay for tires. The company charged that the action of the commission in regulating tire pricing is unwarranted by the facts and not in the public interest.

B. F. Goodrich Co. will also "fight vigorously" the federal government's rule limiting discounts on quantity tire sales. The company said that the order is the first of its kind which the United States government has attempted to impose upon an industry and could only result in chaotic conditions in the manufacture, sale and distribution of replacement tires.

George Burger, vice-president of the National Federation of Small Business, Inc., Washington, D. C., stated that the FTC order will benefit the consuming public by promoting competition based on efficiency.

Nukraft Adding Foam Division

Nukraft Manufacturing Co., Shelbyville, Ind., is presently installing machinery and equipment for the manufacture of foam rubber products. Nukraft has installed a small laboratory across from the main plant, headed by Lloyd Fagel, and has been making foam rubber samples for the past several weeks. Regular Nukraft products in which the foam will be used include bus seat pads and backs, airplane, theater and street car seats and backs, furniture, mattresses, etc.

Preventive Maintenance Moves

Preventive Maintenance Co., formerly located at 1997 Fairfield Avenue, Bridgeport 5, Conn., has moved to 505 Bostwick Avenue in the same city. Preventive Maintenance produces a line of mold cleaners and lubricants. David Hays is president and treasurer of the company and E. A. Wiehl is vice-president and assistant treasurer.

Heads Shoe Products Research

William E. Kavenagh

William E. Kavenagh, for the past 15 years development manager of the Windsor Manufacturing Co., a subsidiary of the Goodyear Tire & Rubber Co. at Windsor, Vt., has been named director of shoe products research and development for the Goodyear organization. Mr. Kavenagh was succeeded as development manager at Windsor by Walter S. Edsall, Jr., his assistant in recent years. Mr. Kavenagh will continue to headquarter at Windsor, Goodyear's major producer of rubber heels and soles and Neolite. Three years ago, Mr. Kavenagh was presented the Litchfield Award of Merit for his part in the development of Neolite. He has been with the company continuously since 1925, but first joined the organization in 1900 as its first rubber compounder. In 1910, he assisted in placing the Bowmanville, Ont., Canada, plant in operation, and in 1914 was placed in charge of mechanical goods development in Akron. He has been in charge of development work on soles and heels since 1930 and has been located at Windsor since 1936. Mr. Edsall has been associated with Goodyear since 1928, moving to Windsor as chief chemist in 1936.

Russia Still Getting Rubber

According to estimates released by the International Rubber Study Group, Russia and her allies are still getting natural rubber. According to the Group, 10,000 tons went to Russia in October, 1951, and another 5,000 tons went to Red China. In the first ten months of 1951, according to the report, Russia received 56,250 tons of natural rubber while 72,800 tons went to Red China. In the first 10 months of 1950, 60,250 tons went to Russia, while 36,000 tons went to Red China.

Opens Branch Office in Paris

Rubber Raw Material Inc., New York, N. Y., has announced that their associate company, Rubber Raw Material, S. A. Brussels, has opened a branch office in Paris, France. The French branch is located at 13 Rue Marivaux, Paris 2. The new branch will enable the parent company to offer better service to customers in France.

Robbins Tire in Tax Suit

Poncet Davis, president of the Robbins Tire & Rubber Co. of Tuscumbia, Ala., has been charged with tax delinquencies by the federal government. The government charges Mr. Davis with avoiding payment on $201,000 in company income and excise taxes. Charges against Mr. Davis were filed in Alabama and listed $125,000 in corporate taxes and $76,000 in excise taxes. These sums, the government says, are still owed in taxes. The period involved in the tax case is the year ending September 30, 1946, for the corporate income tax, and from January 1, 1946, to August of the same year for excise taxes. In a statement to the press, Mr. Davis stated that when the government informed him about a year and a half ago that Robbins tire owed additional taxes, he immediately employed an independent firm of certified auditors to audit the company's books. Mr. Davis stated that he has offered to have his auditors sit down with revenue agents to determine whether Robbins Tire owes additional money. Robbins Tire's president further stated that he has assumed throughout the years that company returns were accurate and reported the full amount of income. When all the facts are brought out, he said, he is confident that it will be clear that there was no deliberate omission of income from tax returns. Mr. Davis is presently free on a $5,000 bond.

Weiner Nylon Hose Wrapping

A new nylon hose wrapping for application prior to the vulcanization of rubber hose has been developed by the Industrial Fabrics Division of the Martin Weiner Co., 1441 Broadway, New York, N. Y. The new fabric is said to possess an extremely fine texture and a remarkable degree of flatness, thus imparting to the hose a finish never before equalled for smoothness. It outlasts by far the conventional hose wrappings now in use, the Weiner firm states. Quality controlled in every phase of its production, the fabric is specially processed and heat-set in the firm's own finishing plant. The Martin Weiner Co. offers a complete line of specially engineered fabrics for coating, laminating and other allied uses in the rubber industry.

Plans New Fiber Glass Facility

Pittsburgh Plate Glass Co., Pittsburgh, Penna., has announced plans to purchase a three-year-old factory at Shelbyville, Ind., as a manufacturing facility for its new Fiber Glass Division. The plant is a 147,000 square foot, one-story structure formerly owned and operated by the National Farm Machinery Cooperative, Inc. Two types of fiber glass, strand fiber and super-fine fiber, will be manufactured at the Shelbyville plant, according to company officials. Super-fine fiber glass has three principal uses—insulation, sound absorption and flotation. Strand fibers are used in the form of yarn as electrical insulation of wires for motors, while chopped strands are utilized to lend rigidity and strength to plastics.

Joins Herron & Meyer of Chicago

John E. Meyer

John E. Meyer, son of Edward T. Meyer, partner of Herron & Meyer of Chicago, Chicago 3, Ill., has joined the firm as an active member. Herron & Meyer of Chicago are crude rubber brokers and manufacturers' agents. John Meyer served in the U. S. Navy during World War II and saw active service in the Far East. After being discharged from the Navy, he attended Beloit College, from where he was graduated in February, 1951.

Sales Changes At U. S. Rubber

The Tire Division of the U. S. Rubber Co. has announced five major changes in its Sales Department. Richard M. Payson, associated with the company since 1948, has been named manager of farm market sales. L. J. Goodman, formerly district manager of Baltimore, Md., has been named district manager at Chicago, Ill. R. S. McClelland has left the post of district manager at Springfield, Mass., to take over the Baltimore district. Edward B. Reynolds, formerly assistant district manager at Philadelphia, Penna., has been appointed district manager at Springfield. J. P. Denvir, Jr., previously a special representative for the Manufacturers Sales Division, has been named assistant district manager in Philadelphia. At the same time, U. S. Rubber also announced the appointment of Harry C. Oliver to the position of assistant sales manager, U. S. Tires. Formerly, Mr. Oliver was Western Divisional Manager for U. S. Tires. It was also announced that Roy W. Collings, previously manager of market development for U. S. Tires, has been named to succeed Mr. Oliver.

Kahn Named Board Chairman

A. M. Kahn, formerly president of the Consolidated Products Co., Inc., New York, N. Y., was named chairman of the board at a recent testimonial dinner marking the 35th anniversary of the company. Herman Kahn was elected president of the company while M. I. Cowen was elected treasurer. A. M. Kahn was recently elected president of Spear & Co., a furniture house in New York. He is also president of the Acme-Hamilton Rubber Co.

RUBBER-STICHTING HOLDS SYMPOSIUM ON ABRASION AND WEAR AT DELFT

Approximately 150 representatives from 11 different countries attended the International Symposium on Abrasion and Wear sponsored by the Rubber-Stichting on November 14 and 15 at its new building in Delft, Holland. After World War II, Rubber-Stichting, in cooperation with sister institutes in Indonesia, England and France, as well as other interested groups, set up a vast research program to deal with the wear of automobile tires.

In carrying out this program, it became clear that wear in itself is a very complex problem, and that research in this field cannot make use of over-simplified concepts or methods of measurement. For example, it has happened that from some tests with a few tires the conclusion was drawn that a certain type of rubber was much more wear-resistant than another. Such conclusions, it has now become evident, must be predicated on a much more thorough and comprehensive investigation.

The fact that these difficulties exist, and that in different fields of material investigation a great deal of work on wear and abrasion has already been done, led the directors of the Rubber-Stichting to arrange this international symposium, where eminent research workers of different branches could give their views on the problems of wear. The symposium was presided over by Dr. R. Houwink, director general for the organization, while the scientific lectures and discussions were led by Dr. H. C. J. de Decker, director of research.

Lecturers at Meeting

Lectures were given by Professor F. P. Bowden, Cambridge University, England; Professor H. Blok of the Technical University of Delft; Professor J. J. Broeze, director of the Royal Dutch Shell Laboratory at Delft; Dr. G. Salomon and Dr. N. A. Brunt, both of Delft, also spoke, as did Dr. A. Schallamach of the British Rubber Producers' Research Association and J. M. Buist of Imperial Chemical Industries, Ltd. The United States was represented by Dr. R. D. Stiehler of the National Bureau of Standards.

In his paper on "Morphological Aspects of Abrasion and Wear," Dr. Salomon emphasized the significance of careful microscopic observations in the analysis of damage caused by abrasion and wear. The comparative method of interpretation, which is employed, is related to that of biological morphology. Two topics were selected for discussion by the speaker: wear of textiles and surface cracking of polymers.

Ozone-cracking of polymers containing olefinic bonds was chosen as an example of crack initiation due to chemical causes. New data are available concerning the ozone-sensitivity of plastics containing olefinic bonds. It was shown that the well-known strain dependence of ozone-cracking varies with the mechanical properties of the polymer film. The evidence presented on chemically-initiated stress-cracking supports the assumption that the rate of crack growth decreases with an increasing rate of stress-relaxation.

In physically-initiated stress-cracking of rubber and plastics, crack-growth resembles that observed in ozone-cracking. Phenomena of stress-cracking in a series of polymers with gradually changing mechanical properties were briefly discussed by the speaker. Finally, an attempt to classify the causes of wear and to show some of the statistical patterns governing them was made by Dr. Salomon.

"Abrasion and Wear of Rubber" was the title of a paper delivered by Mr. Buist. A large number of laboratory tests have been designed for measuring the abrasion resistance of rubber, the speaker noted, but most of these methods do not correlate well with any single service application. In applications where the rubber is subjected to wear, *e.g.*, tires, soles, heels, and proofed rubber garments, great care has to be exercised both in the planning of the service tests and in the actual measurements made.

Analysis and Interpretation

The analysis and interpretation of wear data from service and laboratory tests presents certain difficulties. For example, results are often expressed either as a loss after a fixed time, or as the ratio of the loss of one compound to that of a standard compound, and both methods have defects. If the ratings for two compounds are calculated at progressive stages in a wear test the rating obtained is not constant but varies, depending on the stage reached in the wear curves.

This immediately raises one objection to laboratory abrasion tests where compounds are normally evaluated for a fixed time. As wear curves are available from the service data it is more logical to measure the wear curve in the laboratory test and compare the full wear curves in both cases.

Some years ago the author found that wear curves on the Martindale abrasion test could be described by an impirical equation of the power law type $y = ax^n$. Mr. Buist showed that wear curves for a wide range of compounds tested on a variety of laboratory machines, including the Du Pont and Dunlop (Lambourn) instruments, are all of the same family $y = ax^n$. Wear curves from service data, e.g., road wear data on tires, are also of the same family and there is reason to believe that sole and heel test data could be similarly expressed. The fact that this empirical equation does have such a wide application in the wear testing of rubber in the laboratory and in service is of interest and importance, Mr. Buist said.

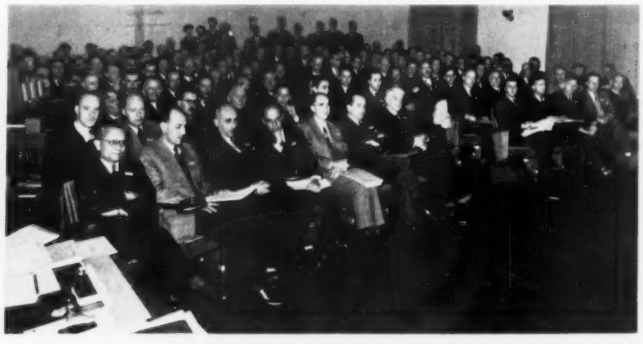
Construction of Wear Curves

Using this method it is possible to construct wear curves from measurements made in the initial stages of wear, and having calculated the constants in the equation for different compounds it is possible to calculate what the wear would be in subsequent stages. Data was presented to show the agreement between the calculated and measured wear values for various laboratory methods and also for road wear tests. By using this technique with one laboratory test, a saving of time in the testing schedule of 75% was achieved. Service tests are more expensive than laboratory tests and any reduction in the duration of these tests is even more valuable than corresponding reductions on the laboratory scale.

With most laboratory tests "n" is >1 whereas in the road wear tests "n" was <1 and it was suggested that the rate of wear should decrease as the test progresses ($n<1$) in both cases if a true comparison is to be made. The effect of various factors on the value of "n" obtained was also discussed.

In the first part of the paper presented by Dr. Schallamach, on "Studies in the Abrasion of Rubber," a very simple case of abrasion was discussed, viz., the effect of scratching rubber with a needle. The second part of his paper dealt with the so-called "abrasion pattern" which is found on abraded rubber surfaces and which consists of an array of approximately parallel ridges oriented at right angles to the direction of motion.

Dr. Schallamach said the scratching experiments were carried out under various conditions of normal load on the needle and at various velocities, provision having



The photograph depicts a typical meeting scene at the Symposium on Abrasion and Wear held by the Rubber-Stichting at Delft, Holland.

been made for the recording of the instantaneous tractive force on the needle. The traces produced by the needle and the corresponding tractive-force time records depend pronouncedly on the nature of the compounds under investigation. In particular, the traces on pure gum vulcanizates are always discontinuous, and the time dependence of the tractive force is given by saw-tooth curves.

Carbon-Loaded Sample Traces

On the other hand, the traces on carbon-loaded samples of the tire tread type are continuous, and the tractive force is subject to very much smaller fluctuations than in the case of pure gum compounds. However, the surface damage on all types of rubbers is characterized by the fact that small pieces of partly detached rubber are found in the wake of the needle and are easily removed when the surface is attacked again. Dr. Schallamach stated that it has been possible to explain the results qualitatively in terms of hardness, friction and tear-resistance of the samples in question.

The abrasion pattern appears both on samples which have been abraded in the laboratory and on tires. In the latter case, the ridges are generally oriented at an angle to the direction of motion of the vehicle.

A cross-section through an abraded rubber surface shows that the profile of the ridges which constitute the pattern is asymmetrical, and it is possible to identify the direction in which the abrasive has moved relative to the abraded surface. Certain other properties of the abrasion pattern have been found in the laboratory, and it has been discovered that during abrasion the pattern moves as a whole in the same direction as the abrasive.

The pattern has proved to be an important clue to the elucidation of the conditions under which abrasion occurs on the road. The origin of the pattern is most probably a direct consequence of the high elasticity and high coefficient of friction of rubber.

Dr. Stiehler's paper on "Some Factors Influencing the Road Wear of Tires" was prepared in association with M. N. Steel and J. Mandel of the National Bureau of Standards. As presented by Dr. Stiehler, the authors stated that three road tests of tires for tread wear were statistically designed. The design of the test equalized the treatment of tires and included a study of some of the factors influencing road wear of tires in addition to the primary object of the test. Among these factors were the effects of vehicle, wheel position, day of test, climatic conditions, and length of storage.

Measurement Methods Studied

A study was also made of two methods of measurement—depth of tread grooves and weight loss. The information on these factors was obtained at no increase in cost of the test. It was found that a tire loses weight at essentially a constant rate, whereas the depth of the tread grooves decreases at a declining rate which results in a bias in the tread wear ratings. The weight method was also found to be more sensitive than the depth method.

The study of the effects of vehicle and wheel positions led to the conclusion that differences in the rate of wear on different wheels do not affect the tread wear comparisons since the rate in slow wearing positions is proportional to that in fast wearing positions and the coefficient of variation is about the same. These results led to the conclusion that geometric rather than arithmetic averages be used in evaluating tread wear.

The study of the effect of day of test and of climatic conditions indicated that the surface temperature of the road and tire has a pronounced effect on the rate of wear. Natural rubber treads containing channel black were faster as the temperature increased; synthetic rubber tread containing furnace blacks were faster as the temperature decreased. Other treads wore at about the same rate as the temperature changed.

Temperature Effects Noted

The effect of temperature on tread wear was greater in many instances than the effect of a lower coefficient of friction on wet roadways. Storage of tires generally increased the rate of wear, although some of the treads did not wear faster after one year of storage. The object of one test was to determine the effect of the type of rubber and black on tread wear. It was found that the rubber and black were mutually independent in their effects. The behavior of natural and synthetic rubbers or of channel and furnace blacks with a change in temperature made it impossible to compare them without stating the conditions of test.

The Goodrich Chemical plant at Louisville, Ky., has been presented with an Award of Honor for Distinguished Service to Safety by the National Safety Council for having completed over 1,500,000 hours of continuous operation without a time-lost injury.

Rubber Flying Saucers

The U. S. Army is experimenting with flying saucers made of synthetic rubber to supply troops in the field with water, gasoline and other liquids. The Army announced that disk-shaped containers have been dropped from altitudes of 400 to 2,000 feet without bursting or spilling their five-gallon contents of liquids. When they hit the ground they stretch to almost double their normal size, bounce back into the air and then settle down near the point of contact. Tests have shown that the containers, made in cooperation with the General Tire & Rubber Co., may be dropped many times without damage. The Army described these "flying saucers" as looking like inflated pancakes, about two feet across and weighing five pounds.

Porcelain Enamel Stripping Trays

Developed originally as a "substitute" measure resulting from the scarcity of non-corrosive metals, porcelain enameled steel stripping column trays used in synthetic rubber processing are compiling a remarkable service record of about 700 hours between cleanings and 2,000 hours between enamelings, according to a field report from the Phillips Chemical Co. Phillips Chemical is using stripping column trays made of 11 gauge enameling iron with 3/16-inch perforations, and coated with a special corrosion resistant grade of porcelain enamel developed and applied by the Erie Enameling Co., Erie, Penna. Each vertical styrene stripping column utilizes 11 trays in series. As latex containing untreated styrene is fed into the top of the columns and drips down through the perforations, steam rises from the bottom and, by distillation, removes unreacted styrene. According to Erie Enameling, porcelain enamel is proving highly satisfactory in this application because latex does not cling so readily to the smooth, glass-like surface, and consequently there is less difficulty with clogging than with trays made of other materials.

3M Forms New Subsidiary

Minnesota Mining & Manufacturing Co., Inc., St. Paul, Minn., has formed a new wholly-owned subsidiary, the Minnesota Mining & Manufacturing International Co., to develop and handle the firm's foreign interests. Minnesota Mining formerly engaged in manufacturing activities abroad through the Durex Corp. in which it had a 28½% interest. It engaged in export through the Durex Abrasives Corp. in which it had a similar interest. The Durex Corp. was dissolved earlier this year in accordance with a government directive. The expansion and development of its foreign interests were reasons cited by Minnesota Mining for forming the new subsidiary. R. W. Young, formerly board chairman of the Durex Corp., has been named president of the new firm. Clarence B. Sampair has been named vice-president; Allan H. Butz, vice-president in charge of sales; Carlton H. Corwin, vice-president in charge of production; and William A. Thomas, vice-president in charge of engineering.

I.R.I. Announces Two Awards

The Council of the Institution of the Rubber Industry has awarded the Colwyn Medal for 1951 to Mr. C. E. T. Mann, director of the Rubber Research Institute of Malaya. Mr. Mann's selection was based on his "conspicuous services to the industry." The Council has also established the Hancock Medal to also be awarded for conspicuous services, but not necessarily of a technical nature. Mr. R. W. Lunn, director of the Leyland and Birmingham Rubber Co., Ltd., has been named as the first recipient of the new medal award. Sir Clive Baillieu, chairman of the Dunlop Rubber Co., Ltd., was recently elected president of the Institution for 1952.

RUBBER INTERESTS IN GERMANY RE-ESTABLISH RUBBER SOCIETY

The Deutsche Kautschuk Gesellschaft (German Rubber Society), originally founded in 1926 and inactive since 1945, was reactivated at a conference which took place on October 11 to 13 in Bad Neuenahr, Germany. The former president of the society, Dr. Erich Konrad, director of the rubber and synthetic materials laboratory of Farbenfabriken Bayer, Leverkusen, was unanimously elected as the first president of the re-established group. Dr. Otto Giese, director of the Gummiwerken Fulda, was elected vice-president.

Alfred Titze was named as director of the German Rubber Society with Dr. Detlef Schmidt as deputy director. Both of these gentlemen are associated with the Trade Association of the German Rubber Industry, Frankfurt-on-Main. Carl Rüger, president of the trade association and managing director of the Metzeler Gummiwerke, A. G., presided at the Rubber Society Meeting.

The conference was attended by more than 300 scientists and technologists from the German rubber industry and by many foreign visitors from France, Holland, Italy, Austria, Switzerland, Sweden and the United States. A number of interesting papers were presented at the meeting. Titles of the papers and their authors, follow:

Congo Rubber (Boström); Modern Methods in the Preparation of Rubber (Bokma); Comparative Estimation of Types of Rubber on the Market (Stöcklin); Rubber and Rubberlike Materials in the Cable Industry (Heering); New Methods of Producing Elastic Raw Materials (Weinbrenner); Plasticization and Reclaiming With Chemical Agents (Schneider).

Also, Observations from the Viewpoint of the Colloid Chemist upon the Processes of Vulcanization and Aging of Rubber (Behre); Chemistry of the Formation of Factice and Allied Reactions (Kirchhof); Compounding Ingredients for the Rubber Industry (von Spulak); Construction of a Rubber-Filler Mix—An Electromicroscopic Study (Endter); Experimental Methods for Determining the Fundamentals of the Functions of Fillers in Rubber (Fromandi).

Also, New Methods for Investigating Rubber-Filler Mixes (Krug); Activity of Pure Fillers (Fredenhagen); Relation Between Filler Activity and Vulcanization (Bottcher); Reciprocal Influences of Rubber and Fillers on the Deformation of Vulcanizates (Kruse); Contribution to the Theory Underlying the Investigation into Structural Stability (Ecker).

Also, Method of Determination of Coefficient of Friction and of Abrasion (Kern); Studies of the Testing of Skid Resistance of Different Qualities of Rubber (Ecker); Properties of Rubber Vulcanizates and Cord under Rapid Molding (Kainradl); Determination of the Deformation Resistance of Pressure-Stressed Soft Rubber Elements and their Relation to Energy Input and Molding Properties (Roelig); Present State of Development in Calender Construction (Mohr).

Each of the papers was followed by a discussion period. Since its inception, the Rubber Society has placed special emphasis on the cultivation of close relationships with rubber technologists of other countries. The Society will continue to foster this interchange of experience and ideas as an important means of furthering scientific progress.

Coming Events in the Rubber Industry

Mar. 3-7. A.S.T.M., Spring Meeting and Committee Week, Hotel Statler, Cleveland, Ohio.

Mar. 4. Kitchener Rubber Group, C.I.C., Dominion Rubber Co., Kitchener, Ont., Canada.

Mar. 4. Los Angeles Rubber Group, Mayfair Hotel, Los Angeles, Calif.

Mar. 6. No. California Rubber Group, Elks Club, Berkeley, Calif.

Mar. 10-19. American Toy Fair, Hotels McAlpin and New Yorker, New York, N. Y.

Mar. 11. Ontario Rubber Section, C.I.C., Hart House, Toronto, Ont., Canada.

Mar. 20. Quebec Rubber and Plastics Group, Queen's Hotel, Montreal, Que., Canada.

Mar. 21. Boston Rubber Group, Hotel Somerset, Boston, Mass.

Mar. 21. Chicago Rubber Group, Morrison Hotel, Chicago, Ill.

Mar. 27. Ft. Wayne Rubber & Plastics Group, Hotel Van Orman, Ft. Wayne, Ind.

Apr. 1. Los Angeles Rubber Group, Hotel Mayfair, Los Angeles, Calif.

Apr. 3. No. California Rubber Group, Elks Club, Berkeley, Calif.

Apr. 4. Akron Rubber Group, Mayflower Hotel, Akron, Ohio.

Apr. 8. Kitchener-Ontario Rubber Groups, Joint Meeting, Dominion Rubber Co., Kitchener, Ont., Canada.

Apr. 17. Quebec Rubber and Plastics Group, Queen's Hotel, Montreal, Que., Canada.

Apr. 17. Rhode Island Rubber Club, Metacomet Country Club, Providence, R. I.

Apr. 30-May 1-2. Rubber Division, A.C.S., Spring Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio.

May 2. Chicago Rubber Group, Morrison Hotel, Chicago, Ill.

May 6. Los Angeles Rubber Group, Hotel Mayfair, Los Angeles, Calif.

May 8. No. California Rubber Group, Elks Club, Berkeley, Calif.

May 9. Connecticut Rubber Group, United Illuminating Co. Auditorium, New Haven, Conn.

May 13. Ontario Rubber Section, C.I.C., General Brock Hotel, Niagara Falls, Ont., Canada.

June 5. No. California Rubber Group, Elks Club, Berkeley, Calif.

June 7-8. Los Angeles Rubber Group, Outing, Hotel Del Mar, Del Mar, Calif.

June 7. So. Ohio Rubber Group, Inland Activities Center, Dayton, Ohio.

June 13. Boston Rubber Group, Outing, United Shoe Country Club, Beverly, Mass.

June 19. Rhode Island Rubber Club, Outing, Metacomet Country Club, Providence, R. I.

June 20. Akron Rubber Group, Outing.

June 23-27. A.S.T.M. Fiftieth Anniversary Meeting, Hotels Statler and New Yorker, New York, N. Y.

Sept. 4. No. California Rubber Group, Elks Club, Berkeley, Calif.

Sept. 9. Connecticut Rubber Group, Outing.

Sept. 11. So. Ohio Rubber Group, Engineers Club, Dayton, Ohio.

Sept. 14-19. A.C.S., Annual Meeting, Atlantic City, N. J.

Sept. 25. Ft. Wayne Rubber and Plastics Group, Hotel Van Orman, Ft. Wayne, Ind.

Oct. 7. Los Angeles Rubber Group, Hotel Mayfair, Los Angeles, Calif.

Oct. 9. No. California Rubber Group, Elks Club, Berkeley, Calif.

Oct. 17. Boston Rubber Group, Hotel Somerset, Boston, Mass.

Oct. 29-31. Rubber Division, A.C.S., Fall Meeting, Hotel Statler, Buffalo, N. Y.

Nov. 6. No. California Rubber Group, Elks Club, Berkeley, Calif.

Nov. 11. Los Angeles Rubber Group, Hotel Mayfair, Los Angeles, Calif.

Nov. 14. Connecticut Rubber Group, Fall Meeting.

Dec. 4. Ft. Wayne Rubber and Plastics Group, Hotel Van Orman, Ft. Wayne, Ind.

Dec. 12. Boston Rubber Group, Hotel Somerset, Boston, Mass.

Dec. 13. So. Ohio Rubber Group, Miami Valley Golf Club, Dayton, Ohio.

Huber Acquires New Plant

J. M. Huber Corp., New York, N. Y., has acquired the Hartford County distillery at Havre De Grace, Md. The company plans to transfer a pilot plant operation for processing clay from Borger, Texas, to the new location. The Maryland plant will provide employment for about 40 workers.

Named Goodrich Chemical Head

John R. Hoover

John R. Hoover, associated with the B. F. Goodrich Co. since 1925, has been named president of the B. F. Goodrich Chemical Co., Cleveland, Ohio, succeeding William S. Richardson, whose increased responsibilities as vice-president of the parent company will include the chemical firm. Mr. Hoover, formerly vice-president of Goodrich Chemical, joined the Goodrich organization as a chemist in the company's works laboratories in Akron. He then moved into the Footwear Division and later became manager of the works laboratories. His sales career began in 1932 when he was made assistant sales manager of the Rubber-Lined Equipment Department and the sale of other products for the chemical industry. Mr. Hoover later became sales manager of that department and in 1942 assumed direction of B. F. Goodrich plastics materials sales. When Goodrich Chemical was formed in 1944, Mr. Hoover was made general manager. In 1945, he was elected vice-president in charge of sales. Mr. Hoover was graduated from Harvard University in 1925 with a degree in chemistry. He has been president of the Plastic Materials Manufacturers Association, Inc. He is a member of the Society of the Plastics Industry, the Society of Plastics Engineers, the American Institute of Chemical Engineers, and the Chemists' Club of New York.

OIT Ups Thermal Black Quotas

Although the over-all export quota for furnace carbon black has been left unchanged at 32,500,000 pounds for the first quarter of 1952, the Office of International Trade has announced that special licensing ceilings on semi-reinforcing furnace black have been raised to 10,500,000 pounds for the quarter, against 8,500,000 pounds at the end of 1951. At the same time, OIT raised the ceiling on thermal black to 6,000,000 pounds, from the 5,500,000 pounds in the fourth quarter of 1951. OIT will continue to issue licenses for channel black to meet essential requirements of friendly foreign countries without specific quantitative limitation in the first quarter.

WASHINGTON APPOINTMENTS

Wesley S. Walker, on leave from his post as product manager for nitrogen of the Linde Air Products Co., New York, N. Y., has been named director of the General Industrial Equipment Division of NPA.

Frederic Arden, formerly chief of the Inorganic and Agricultural Chemicals Branch, NPA, has been named assistant director of the NPA Chemical Division, a newly-created position. Mr. Arden is on leave from the Mathieson Chemical Corp. where he is director of market research.

Dr. W. A. Nyland, formerly deputy chief of the former NPA Plastics and Protective Coatings Branch, has been named chief of the newly-established Protective Coatings Branch.

George M. Hebbard, previously deputy chief of the NPA Inorganic and Agricultural Chemical Branch, has been made chief of the branch. He is on leave from his position as vice-president of the Davison Chemical Corp.

Sublac PX-5 Powdered Resin

The development of a new light-colored, oil resistant powdered resin exhibiting some unusual properties in rubber compounds has been announced by The Polymel Corporation of Baltimore, Md. Called Sublac PX-5, the new material when used in combination with Polymel C-130 in GR-S and natural rubber sole stocks is said to eliminate the need for zinc oxide and accelerators. Despite the lack of accelerators in such stocks, the company claims that optimum cure can be reached in 10 minutes at 325° F. One test stock cured in this manner is reported to have shown a tensile strength of 1200 psi, elongation of 250%, modulus of 900 psi (at 200%), and a hardness of 81. Sublac PX-5 is also reported to impart a preservative quality to unvulcanized neoprene compounds, preventing the setting-up of such compounds. Although some acceleration is required with neoprene stocks, the new resin is said to aid processing and to generally improve physical properties.

Collyer Urges Cartel Ban

In advance of Prime Minister Winston Churchill's recent visit to the United States, John L. Collyer, president of the B. F. Goodrich Co., in a letter to Charles E. Wilson, Director of Defense Mobilization, hit out against any cartel agreements in rubber. Mr. Collyer said he was concerned by continuing reports, some of them in connection with Mr. Churchill's visit, that the government may again be under pressure to enter into rubber agreements. "There is no justification for participation by the United States government in any form of fixed-price or cartel agreement in rubber," he declared. Such arrangements, he warned, would perpetuate grossly inflated prices for natural rubber, adding unnecessarily to the already high tax burden borne by American citizens.

Forms Molded Goods Division

Ward W. Killion

Spencer Rubber Products Co. of Manchester, Conn., manufacturer of phenolic rubber sponge and rubber bands for office, industrial and agricultural use, has formed a Molded Goods Division for the manufacture of industrial molded rubber goods. Ward W. Killion has been named to head the new division as manager. Mr. Killion joins Spencer after serving three years as assistant sales manager of the Tyer Rubber Co., Andover, Mass. Previously he was with the Goodyear Tire & Rubber Co. in various capacities for 15 years in the Mechanical Goods Division. The last 6 years of his association with Goodyear were spent as a special sales engineer at the St. Marys, Ohio, molded goods plant. Spencer Rubber has added modern tool making and molding equipment to produce a wide range of precision molded rubber products in practically any size, shape or form. The company is also reported to have one of the most complete and up-to-date rubber research laboratories in the east. The company is presently supplying many precision parts to the aircraft industry.

Polyethylene Air Force Balloons

Officials of the United States Air Force have announced a new research project for the study of wind directions and velocities over the United States at Altitudes between 50,000 and 100,000 feet. Giant plastic balloons made of polyethylene film ranging from one to three-thousandths of an inch thick will be utilized. Air Force officials warned that the balloons being used may appear as "flying saucers" in the early and late hours of the day because of sun reflections from their transparent surfaces. They added that the fully-inflated balloons would be 50 to 100 feet in diameter, up to 130 feet long, "clearly visible at 100,000 feet" on cloudless days and "similar in appearance to a small moon" at that altitude. In the event a collapsed balloon is found, the Air Force announcement said, directions for returning the radio transmitter section will be attached to the unit. The useful transparent balloon cover may be kept by the finder as a reward for return of the radio equipment.

NO. CALIFORNIA HEARS CHALMERS ON PHOTO-ELASTIC APPLICATIONS

The November 29th meeting of the Northern California Rubber Group, held at the Elks Club in Berkeley, Calif., heard an interesting talk by Douglas Chalmers, general manager of the Golden State Rubber and Latex Corp., Los Angeles, Calif. Mr. Chalmers spoke on "Photo-Elastic Applications in Rubber Technology."

In his talk, the basic problem of rubber product design was introduced with reference to complexities encountered due to the non-linear stress-strain character of rubberlike materials. The limitations in "drawing board design" of rubber products was further related to the lack of adequate "hand book" data to cover the myriad possible commercial compounds.

The fundamental design approach is the selection and profiling of structural materials to withstand service forces. It is further the design objective to so select and profile that all parts of the design in service are subjected to stresses at the lowest percentage of ultimate strength, he said.

Mr. Chalmers reviewed briefly some modern design testing techniques for particular service problems enabling calculation or observation of specific stresses encountered in actual structures or models. Among these techniques are grid analysis, strain gauge applications, stress coat technique, and photo-elastic analysis. The latter technique was then discussed with the use of simple models and polarizor plate assembly.

It was demonstrated that certain pure gum rubbers and translucent rubberlike plastics show the typical photo-elastic effect resulting from strains imposed upon models in the path of light polarized by typical polaroid films.

The interpretation of photo-elastic fringes was demonstrated and explained with reference to the intensity and direction of major stresses in model sections. Typical facsimile product sections were used to demonstrate how this method could be used to improve field performance and analyze otherwise obscure field failures.

Akron To Hold Reclaim Symposium

"Reclaim—Processes and Uses" will be the subject of the fifth annual midwinter symposium of the Akron Rubber Group to be held during the afternoon of February 1 at the Mayflower Hotel in Akron. A panel of experts from the rubber industry has been assembled to discuss the subject and answer questions pertaining to all phases of the manufacture and use of reclaim. Members of the panel include William Welch (Midwest Rubber Reclaiming), Jean H. Nesbit (U. S. Rubber Reclaiming), Ted A. Johnson (Goodyear), William J. Boyd (Xylos), and Earl B. Busenberg (Goodrich). The afternoon technical session will start at 2:00 P. M., and will be followed by a social hour, dinner, and an evening program of entertainment.

Rubber-Coated Garden Tools

According to reports from England, rubber experts at the Department of Scientific and Industrial Research at Teddington (Middlesex) have developed a rubber coating for garden tools designed to protect them from winter weather. A mixture of sodium benzoate and natural latex provides a coating which will protect metals in leaky or damp storage places. Garden tools dipped in the solution will be completely protected until the coating is peeled off, the reports state.

BUFFALO HOLDS CHRISTMAS PARTY; ELECTS OFFICERS FOR 1952 SEASON

Approximately 150 members and guests of the Buffalo Rubber Group attended the Annual Christmas Party which was held on December 18 at the Buffalo Athletic Club in Buffalo, N. Y. The meeting featured an election of officers for the 1952 season.

Members elected to office include: *Chairman*, Fred Kohlhagen (Globe Woven Belting); *Vice-Chairman*, Ray Lowry (Hewitt-Robins); *Secretary-Treasurer*, Joseph W. Beecher (Globe Woven Belting). Ed Martin and Charles Johnson (Hewitt-Robins) and Frank Maroceo (U. S. Rubber Reclaiming) were named members of the Executive Committee.

A short business meeting of the Executive Committee and directors was held under the supervision of Seward Byam (DuPont), vice-chairman of the Division of Rubber Chemistry, American Chemical Society.

The program for the Christmas Party included a cocktail hour and dinner followed by several vaudeville acts. The party concluded with a drawing for prizes.

Washington Holds Xmas Party

The Annual Christmas Party of the Washington Rubber Group, held on December 18 at the Old Georgetown Hospitality Hall of the Christian Heurich Brewery in Washington, D. C., featured a "Gay Nineties" motif. Members and guests enjoyed dancing, community singing and a program of skits presented by group members. A buffet supper was served with free beer provided by the Heurich Brewing Co.

Chicago Group Holds Xmas Party

Some 850 members and guests of the Chicago Rubber Group attended the Annual Christmas Party and Ladies' Night on December 14 in the Morrison Hotel, Chicago, Ill. Beautiful all-wool stoles were presented to the lady guests with the compliments of the group. The evening's festivities included a seven-course turkey dinner and an eight-act floor show, climaxed with music for dancing.

FT. WAYNE GROUP HOLDS PANEL ON AUTOMOTIVE RUBBER-PLASTICS

The second meeting of the Fort Wayne Rubber and Plastics Group was held on November 29 at the Van Orman Hotel in Fort Wayne, Ind., with approximately 250 members and guests in attendance. The meeting featured a panel discussion on the "Present and Future Uses of Rubber and Plastics in the Automotive Industry." J. R. Shroyer (R. T. Vanderbilt) acted as moderator for the session.

The panel was composed of H. V. Beckerleg (Fisher Body), A. L. Carter (Chrysler), A. J. Kearfott (General Motors), M. J. Sturtevant (Chrysler), and J. K. Totten (Ford Motor). The discussion consisted entirely of questions put to the panel from the floor. Interest in the session was such that Mr. Shroyer had to call a halt to the proceedings due to the lateness of the hour.

A brief business meeting preceded the technical session under the direction of Daniel Reahard (General Tire), chairman of the group. Mr. Reahard introduced Seward G. Byam (DuPont), who spoke on the requirements necessary for the Fort Wayne Group to qualify for a charter under the Division of Rubber Chemistry.

Elmer J. Ramga (U. S. Rubber) was awarded membership card No. 1 in recognition of his service in organizing the group. Mr. Ramga is presently secretary-treasurer of the group.

Connecticut Group Hears Savage

The November 30th meeting of the Connecticut Rubber Group, held at Rapp's Restaurant in Shelton, Conn., featured an address by Richard Savage of the General Electric Co., Waterford, N. Y. Mr. Savage spoke on "Compounding and Controls in the Production of G-E Silicones." The session was presided over by C. A. Larson (Whitney-Blake). Mr. Savage's paper covered the properties and range of silicone stocks made by General Electric. Compounding and curing techniques were discussed. The chemistry of the silicones, type of chain linkage when various types of curing agents are used, and the effect of various fillers on the physical properties of silicone rubber were all ably presented. The talk was illustrated with slides and was followed by a question-and-answer period.

Boston Group Elects Officers

The Annual Christmas Party of the Boston Rubber Group, held on December 14 at the Somerset Hotel, Boston, Mass., featured an election of officers for the 1952 season. Members elected to office include: *Chairman*, John Andrews (Cabot); *Vice-Chairman*, Alan W. Bryant (Binney & Smith); *Secretary-Treasurer*, W. Fraser Malcolm (Titanium Pigment). E. D. Covell (Stedfast Rubber) was named to the Executive Committee for a 1-year term and J. E. Williamson (Tyer Rubber) for a 2-year term. The Christmas Party featured a cocktail hour, dinner, entertainment and the presentation of door prizes.

So. Ohio Announces New Officers

The Southern Ohio Rubber Group held its Annual Winter Meeting on December 15, 1951, at the Miami Valley Golf Club, Dayton, Ohio, at which the results of a letter-ballot for officers and directors were announced. Members elected to office for the 1952 season are: *Chairman*, Jack Feldman (Inland Mfg.); *Chairman-Elect*, George Lang (Johnson Rubber); *Treasurer*, Dayle Buchanan (Inland Mfg.); *Secretary*, Russell J. Hoskin (Inland Mfg.). Members elected as directors for a 3-year term included William L. Nolan (Inland Mfg.), Harry Brubaker (Witco Chemical), and John Poffenberger (Cincinnati Rubber Mfg.). Other directors include Roger R. Hickernell (Monroe Auto Equipment), William Whittaker (Herron Bros. & Meyer), Ralph B. Appleby (DuPont), Herbert S. Karch (C. P. Hall), Joseph Rockoff (Dayton Rubber), John M. Walsh (Xylos Rubber), and Louis J. Keyes (Dayton Rubber). The meeting featured the serving of a fine Christmas dinner and the distribution of favors and door prizes. Dancing and card playing concluded the evening's program.

Kitchener Group Hears Wolfe

The December 4th meeting of the Kitchener Rubber Group of the Chemical Institute of Canada, held at the plant of the Dominion Rubber Co. in Kitchener, Ont., Canada, featured an address by Dr. George M. Wolfe (Sharples Chemicals) on "The Place of the Compounder in the Rubber Industry." The talk was originally scheduled to be delivered by Dr. B. S. Garvey, Jr., but ill health prevented his appearance. The talk as presented by Dr. Wolfe was very much the same as that delivered by Dr. Garvey before the recent meeting of the Division of Rubber Chemistry in New York City. The first part of the paper was devoted to a discussion of the place of the compounder in the rubber industry and to his method of operation. The last part was a general survey on elastomers and other compounding materials.

New York Holds Xmas Party

The New York Rubber Group held its gala annual Christmas party on December 14 at the Henry Hudson Hotel in New York City. In the absence of chairman J. A. S. Corrigall (R. T. Vanderbilt), retiring chairman M. R. Buffington (Lex Fabrics) turned the meeting over to George Vacca (Bell Telephone Labs), vice-chairman for 1952. The party featured a cocktail hour which was followed by dinner and a program of entertainment. The evening's festivities concluded with a drawing for many beautiful and useful door prizes. Approximately 430 members and guests attended the meeting.

Detroit Holds Gala Xmas Party

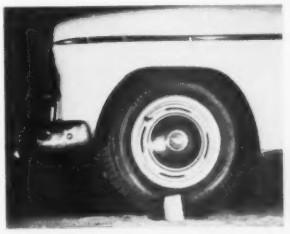
On December 14, the Detroit Rubber and Plastics Group held its Annual Christmas Party at the Hotel Book-Cadillac in Detroit, Mich. The meeting featured a program of entertainment and the distribution of beautiful and useful door prizes.

Effects of Obstacles on Tires

Seiberling Rubber Co., Akron, Ohio, has released two interesting photographs which depict what happens when a tire strikes a brick as an automobile moves at high speed. To study effects of road obstacles on tires, Seiberling took the photographs at 1/15,000 of a second, using electronic flash to stop the action at the critical

Photograph A

moment. The test car was traveling at 40 miles per hour when it struck the paving brick. Tire pressure was 24 pounds when the tests started but under repeated runs built up to 25 pounds. Photograph A shows the tire as it was "stopped" at 1/15,000 of a second. The light streaks in the photograph were made by the headlights of the car. This light could not be stopped during the relatively slow open



Photograph B

flash portion of the picture. Photograph B shows the same test on another run. Seiberling engineers emphasize that they do not recommend this kind of treatment for any tire since even the best tire cannot stand up very long under such punishment. Tires driven over rough pavements at high speed undergo similar torture.

Amtico Plastex Rubber Flooring

American Biltrite Rubber Co., Trenton, N. J., has introduced a new combination rubber and plastic product called Amtico Plastex Rubber Flooring. According to the company, the new product is said to combine the desirable characteristics of both rubber and plastic. The new flooring is packaged in cartons holding 36 square feet of 6 by 6-inch tiles and 40½ square feet of 9 by 9-inch tiles. Amtico Plastex has been tentatively standardized in the eight most popular marbelized colors.

Israeli Plant to Begin Operation

Production lines will be operating within the next few months on Israel's largest tire and rubber plant, although its size has been doubled while construction of the $3,000,000 structure was being pushed. This was reported recently by Arthur Taubman, Virginia banker, who heads a group of American investors cooperating in the construction under a unique agreement between the American interests and the General Federation of Labor in Israel, known as Histadrut. Each is putting up half the capital. Mr. Taubman said the project's speed was the result of efforts by A. L. Freedlander, president of the Dayton Rubber Co. Dayton Rubber designed the plant and will provide technical service and assistance for the next ten years. The plant originally had been planned to be about 70,000 square feet. However, when shares of Alliance Tire and Rubber Co., Ltd., an Israeli corporation, were offered in the United States and in Israel, the response was so heavy that the space was increased to 120,000 square feet. There is room on the ten-acre site for this figure to be doubled. The Israeli share of the corporation's stock was subscribed at once by Histadrut, which is not only a labor federation but operator of the country's largest group of automotive transport lines and is expected to consume at least 60% of the plant's output. A number of executives for the new plant, including Joseph Teicher, who will be general manager, are in training at Dayton, according to Mr. Freedlander. These executives will spend periods up to six months training local personnel.

No. Calif. Elects Officers

The Ninth Annual Christmas Party of the Northern California Rubber Group, held on December 14 at the Planters Dock, Berkeley, Calif., featured an election of officers for the 1952 season of the group. Members elected to office include: *President*, Neil McIntire (Oliver Tire); *Vice-President*, Joseph Hollister (Mare Island Rubber Laboratory); *Secretary*, James Sanford (American Rubber Mfg.); *Treasurer*, William Deis (Goodyear Rubber). Halsey Burke (Burke Rubber), Bill Moser (Pacific Tire) and Leonard Hohl (American Rubber Mfg.) were named as directors of the group. The Christmas party featured dinner, dancing, entertainment and the presentation of door prizes.

Detroit Group to Hear Cadwell

Dr. S. M. Cadwell, director of research and development of the United States Rubber Company will be guest speaker at the meeting of the Detroit Rubber and Plastics Group, Inc., to be held February 15th at the Detroit Leland Hotel. Dr. Cadwell, who is very well known for his many contributions to the scientific advancement of rubber, will talk about "Gum Plastics", a new family of versatile materials with a wide range of properties not completely shared by either soft or hard rubbers or the conventional plastics. The meeting will start with dinner at 7 P.M.

ADDITIONAL TECHNICAL PUBLICATIONS OF BRPRA MADE AVAILABLE

Abstracts of some of the recent publications issued by the British Rubber Producers' Research Association are published from time-to-time in RUBBER AGE. These booklets, which cover research work conducted by various members of the BRPRA staff, may be secured by writing the Association at 19 Fenchurch Street, London E.C. 3, England. Abstracts of some of the more recent publications follow:

Radical Mechanisms in Saturated and Olefinic Systems. Part I. Liquid-phase Reaction of the *tert.*-Butoxy-radical with Olefins and with cycloHexane, by E. H. Farmer and C. G. Moore. Part II. Disubstitutive Carbon-Carbon Cross-linking by *tert.*-Alkoxy-radicals in Isoprenic Olefins and Rubber, by E. H. Farmer and C. G. Moore. Part III. The Reaction of Hydroxyl Radicals with Olefins, by E. H. Farmer and C. G. Moore. The Thermal Decomposition of Dihydroascaridole, by C. G. Moore. The Reaction of Di-*tert.*-Butyl Peroxide with Butan-2-One and Cyclohexanone, by C. G. Moore. (Publication No. 141): Publication No. 141 comprises the first three parts of a series of papers titled "Radical Mechanisms in Saturated and Olefinic Systems" together with two short notes, the first titled "The Thermal Decomposition of Dihydroascaridole" and the second "The Reaction of Di-*tert*-Butyl Peroxide with Butan-2-one and *cyclo*Hexanone".

In Part I of the above series a study has been made of the liquid phase reaction at 140° of *tert*-butoxy radicals, derived from di-*tert*-butyl peroxide, with mono-olefins, alkylbenzenes and with *cyclo*hexane. The *tert*-butoxy radicals display a reactive tendency towards the non-vinylic olefins and the alkylbenzenes which is practically confined to the dehydrogenation of α-methylene groups, thereby producing olefin radicals which achieve stabilization by self-union, giving first dehydro-dimers and then subsequently dehydro-trimers, etc. Vinylic olefins posses a dual reactive capacity, undergoing both additive polymerization initiated by radicals and also dehydrogenation and subsequent "dehydropolymerization" like the non-vinylic olefins. Saturated hydrocarbons are attacked by *tert*-butoxy radicals at 140°; thus, *cyclo*hexane yields *cyclo*hexyl radicals, which couple to give di*cyclo*hexyl and then by further dehydrogenation and coupling higher (partially unsaturated) polymers.

Part II extends the reaction of *tert*-butoxy radicals with olefins to a series of low molecular polyisoprenes and to rubber hydrocarbon. The high degree of dehydrogenation effected by *tert*-butoxy radicals at the α-methylene groups of olefins enables these radicals to be used for the carbon-to-carbon cross-linking of unsaturated carbon chains. Such cross-linking amounts to a vulcanization process in which the connecting links between chain molecules are just C-C bonds. Good vulcanizates are obtained from rubber in which the tensile strength increases towards a maximum and then declines rapidly as the degree of cross linking steadily increases. Study of the "dehydropolymers" derived from the polyisoprenes, dihydromyrcene and digeranyl suggests that the cross-linking reaction may be accompanied by a prior cyclization reaction. Thus, the peroxide vulcanizates may possess, in parts, a cyclized structure.

In Part III the liquid-phase reaction at 140° between mono-olefins and *tert*-butyl hydroperoxide has been studied. Considerable yields of α-hydroxy- and α-ketone derivatives of the original olefin and its "dehydro-dimer" are suggestive of tert-butoxy- and hydroxyl radicals being the reactive entities. The work gives a qualitative picture of some of the possible reactions which may operate in the secondary stages of polyisoprene oxidation.

In the first note it is shown the dihydroascaridole, which is a di-*tert*-alkyl cyclic peroxide, conforms in its mode of decomposition with its acyclic analogues giving by a free-radical decomposition reaction a 1:4-diketone. Dihydroascaridole is unreactive towards mono-olefins at 140° and the contrasts of this with the considerable reactivity of di-*tert*-butyl with olefins is discussed.

The second note describes how the dehydrogenative reactivity of *tert*-butoxy radicals has been utilized to "dehydropolymerize" cyclic and acyclic monoketones. The reaction mechanism advanced closely parallels that suggested for the reaction of *tert*-butoxy radicals with non-vinylic olefins.

The Reaction of Olefins with Sulphur and with Hydrogen Sulphide, by G. F. Bloomfield and R. F. Naylor. (Publication No. 142): This paper was contributed to the XIth International Congress of Pure and Applied Chemistry in 1947, and made a contribution to the knowledge of the mechanism of vulcanization at a fairly early stage of BRPRA researches.

In sulfur vulcanization, the degree of cross-linking achieved in terms of the number of sulfur atoms introduced per rubber molecule is of a relatively low order. Experiments with small organic molecules containing the same basic structure as the rubber molecule shows that the cross-linkages are, in fact, made up of chains of sulfur atoms, and, furthermore, a proportion of the sulfur enters into rings (cyclic sulfides) containing 4 or 5 carbon atoms and one sulfur atom, instead of into cross-linkages.

Hydrogen sulfide adds to these substances to give very similar cyclic sulfides, the structures of which have in two instances been confirmed by synthesis. Similarities in the infra-red absorption spectra of these cyclic sulfides and those derived from the reaction of sulfur enable important conclusions to be drawn as to the type of cyclic sulfide formed in vulcanization and the nature of the reactive mechanisms involved.

The cross-linkage comprising a chain of sulfur atoms is somewhat unstable at the temperatures prevailing during vulcanization, and considerable secondary reaction can be shown to occur between initially-formed polysulfides and other parts of the rubber molecules. Cyclic products are highly probably products of such secondary reactions, and it has been shown that prolongation of the time of heating during vulcanization at temperatures around 140°C. gives a progressively greater ratio of cyclic linkages to cross-linkages.

Dielectric Relaxation of Neutral Rubber Vulcanizates, by A. Achallamach. (Publication No. 143): The dielectric loss tangents of different types of pure gum vulcanizates of natural rubber have been measured as functions of the frequency. It has been found that for a given amount of combined sulfur, the loss tangent decreases with increasing modulus of the rubber, and it is suggested that the dielectric loss is mostly due to sulfur which has been combined in forms other than cross links. The dielectric relaxation time is approximately an exponential function of the percentage of combined sulfur. Moisture has been shown to increase the dielectric losses seriously in the audio-frequency range but to have little effect at radio-frequencies.

Large Elastic Deformations of Isotropic Materials. VII. Experiments on the Deformation of Rubber, by R. S. Rivlin and D. W. Saunders. (Publication No. 147): In previous papers of this series it has been shown how the elastic properties of an ideal incompressible highly-elastic material may be specified in terms of a stored-energy function. The load-deformation relations for a number of simple types of deformation have been determined in terms of this stored-energy function. In this paper these formulae are compared with measurements on suitable test-pieces of a pure gum natural rubber vulcanizate in order to find the stored-energy function for the vulcanizate. The stored-energy function so obtained is used to predict the load-deformation relations for other forms of test-piece and these predictions are compared with measurements. **VIII. Strain Distribution Around a Hole in a Sheet, by R. S. Rivlin and A. G. Thomas:** The deformation produced by radial forces in a thin circular sheet of incompressible highly elastic material, isotropic in its undeformed state, containing a central circular hole, is studied theoretically, and results calculated on the basis of the theory are compared with those obtained experimentally employing a vulcanized natural rubber compound as the highly elastic material. In both these papers, the agreement between theory and experiment is very satisfactory.

So that potential users can see blast cleaning and dust control equipment in operation, the Pangborn Corp. has opened a new demonstration room at its plant in Hagerstown, Md. The room, 58 by 61 feet in size, was opened for an audience for the first time at the company's September open house.

ASA STANDARDIZATION SURVEY CITES RUBBER COMPANY REPORT

The benefits of standardization in the chemical and rubber industries are cited in "Dollar Savings Through Standards," a comprehensive survey of savings realized by use of standards in American industry. Released by the American Standards Association, 70 East 45th St., New York 17, N. Y., as a service to American industry, this 32-page report presents 140 case studies covering 81 industries and industrial products. Five of the case studies relate to the chemical and rubber industries.

Approximately 2,100 companies, members of the ASA, were polled for data on results obtained by adoption of standards in their operations. Their answers, compiled in this survey, give the first assemblage of measurable proof, in terms of dollars and percentages, of the savings accomplished through the use of standards.

Field teams of the Economic Cooperation Administration are using this survey in Europe now to show manufacturers in Marshall Plan countries a demonstration of the value of standardization. By this and other means, they hope to persuade Marshall Plan countries to speed up the use of standardization procedures to the end that production of civilian and military goods will accelerate.

A pronounced growth in the use of standards has developed since the end of World War II, especially in the last two years, this survey reveals. Manufacturer after manufacturer told of having adopted new standardization programs, while others referred to standards systems not yet completed or about to be initiated. Of particular interest is the report from one of the major rubber and tire manufacturers. Excerpts from this letter follow:

"Our Standards people tell us that over the years they have developed some pretty definite criteria by which they can make rather close estimates of the savings accruing from the application of standards in the several areas of our business concerns. When this is done, they report, the following interesting figures emerge:

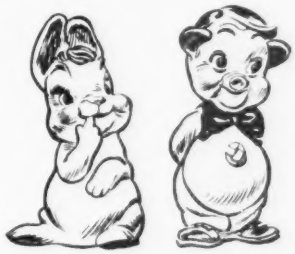
Economies Resulting from Standardization of:	*Annually*
Purchasing	$20,000,000
Engineering	5,000,000
Production	25,000,000
Distribution	5,000,000
General	10,000,000
	$65,000,000

"Of course, these are cumulative figures, the result of long-standing efforts to simplify, to reduce, to make uniform, to make interchangeable, to schedule—all aspects, as you know, of the over-all job of standardization."

Phenolic resin modified with Hycar rubber is solving many engineering problems for the Compo Shoe Machinery Co., Boston, Mass. Among the applications using Hycar rubber is a washer, a Hycar-phenolic roller, a horn rubber for removing soles from a last, wedges for shaping the sole of finished shoes, etc.

Topstone Rubber Squeeze Toys

Topstone Rubber Toys Co. of Bethel, Conn., has added a new line of animal squeeze toys featuring designs of unusual characters created by Keith Ward, well-known artist and illustrator of children's books. These molded natural latex squeeze



toys are of generous size and are individually packaged in cellophane bags. Two of the toys in the line, "Bashful Bunny" and "Peter Porker," are shown herewith. Other creations in the line are "Buttercup Bear" and "Leo Lion." Each of the toys has a large squeaker which is sealed in the body. The toys are handpainted with a new type of washable, harmless colors.

Goodrich Plans Chicago Exhibit

A 60-foot high guillotine on which visitors can try to "execute" a puncture-sealing tubeless tire will be one of the features of a massive new rubber exhibit to be opened next spring by the B. F. Goodrich Co. at the Museum of Science and Industry in Chicago, Ill. The test, one of many which the 2,000,000 visitors each year will have a chance to conduct through push-buttons, will be used to demonstrate the durability of synthetic rubber. Goodrich officials said the company's exhibit will occupy 8,280 square feet of floor space, including a model theater where visitors will be shown a movie of the step-by-step manufacture of tires. The exhibit, a five-year project, will be one of the most elaborate undertaken by the company. Displays will be built by leading firms in order to speed the installation. Actual planning and layout will be done in Akron.

Holmes Forms Service Agency

Frank O. Holmes, Jr., who recently returned to this country from Sweden where he was associated with Goodyear Gummi Fabriks AB at Norrkoping as technical superintendent, has formed his own business at 1758 Sixteenth St., Cuyahoga Falls, Ohio, to serve Swedish and other European firms as a contact man in the chemical and engineering fields. About two years ago, Mr. Holmes helped found the Institution of the Rubber Industry in Sweden, which organization he has served as president since its inception. The organization, patterned after the rubber groups of the American Chemical Society, now has a membership of 125 and includes representatives from Norway, Sweden, Denmark and Finland.

FIRESTONE GERMAN INVESTMENT TO BE GUARANTEED BY ECA FUNDS

As reported in our previous issue, the Firestone Tire & Rubber Co. and the Harburger Gummiwaren-Fabrik Phoenix Aktiengesellschaft of Hamburg, Germany, have concluded an agreement providing for the interchange of technical information and assistance between the two companies. Further details have now become available in that the Economic Cooperation Administration has announced that a $2,894,100 government guarantee will cover Firestone's investment in the German company.

ECA said the Firestone-Phoenix arrangement provides that Phoenix will produce tires and tubes, similar to those made by the U. S. firm, plus "such other products as may be agreed upon between the two companies." In return for a minority stock interest in Phoenix, Firestone is sending patented and technical data, engineers and some machinery and equipment to the German firm. Some German workers will be trained in Firestone factories in the U. S. Firestone will grant Phoenix the right to use the name "Firestone-Phoenix" on products made by Phoenix under Firestone-approved specifications.

The Firestone agreement with Phoenix is unusual in two key respects. It is the first private U. S. investment overseas receiving two types of ECA guarantees—one covering currency convertibility and the other covering confiscation or expropriation. The convertibility guarantee insures Firestone that it can convert into U. S. dollars up to $1,841,700 of its earnings from its German investment. The other guarantee provides that Firestone will be paid up to $1,052,400 in case of loss through foreign governmental expropriation or confiscation.

The ECA convertibility pact is also unique in that it provides for a minimum rate of exchange in the conversion of Firestone's German earnings. It guarantees that Firestone can convert its receipts at a rate not less favorable than 61% of the "official" German rate.

More Certificates of Necessity

The Defense Production Administration has issued a new list of approved Certificates of Necessity for accelerated tax amortization on new or expanded defense facilities. Certificates issued recently include:

General Cable Corp., Perth Amboy, N. J., was authorized 60% of the amount for which it had applied for the manufacture of field wire.

Hewitt-Robins Inc., Buffalo, N. Y., $53,244 for the production of fuel tanks.

General Cable Corp., Bayonne, N. J., $186,514 for the production of field wire.

B. F. Goodrich Chemical Co., Avon Lake, Ohio, $5,377,960 for the production of polyvinyl chloride resins.

General Cable Corp., St. Louis, Mo., $678,500 for the production of field wire.

Simplex Wire & Cable Co., Cambridge, Mass., $775,900 for the production of Signal Corps wire and cable.

NEWS IN BRIEF

Dewey & Almy Chemical Co., Cambridge, Mass., has issued a new folder listing principal markets served by the company, its factories and manufacturing subsidiaries.

A new fast-cure phenolic compound has been developed by the Chemical Division of the General Electric Co., that is said to speed cure time on molded parts. Designated as G-E 12853, the new compound is recommended for those applications presently being molded with general purpose phenolic materials.

Frederick S. Bacon Laboratories, Watertown 72, Mass., has issued a new Technical Data Sheet (No. 102) covering silicone rubber O-rings as molded by the company. Copies of the data sheet are available on request to the company.

A huge vinyl plastic-lined sewer pipe nearly seven miles long and over two yards in diameter is being installed in Orange County, Calif. The reinforced concrete pipe is lined with "T-Lock Amer-Plate," a plastic sheeting made of Geon, manufactured by the Amercoat Corp., South Gate, Calif.

Midwest Rubber Reclaiming Co., East St. Louis, Ill., has issued Report No. 15 covering "Midco B in a Tread Compound with Various Types of GR-S."

Columbia-Southern Chemical Corp. has released Pigment Data Bulletins No. 51-3 and 51-4. The first of these bulletins covers "Calcene T," the fine particle size precipitated calcium carbonate, and the other "The Mixing of Hi-Sil Loaded GR-S Compounds."

U. S. Rubber Export Co., Ltd., a subsidiary of U. S. Rubber, has leased the entire 20th, 21st and 22nd floors of the new 32-story Chrysler Building East in New York City where it will move in the spring of 1952.

The national sales organization of the General Tire & Rubber Co., meeting recently in Akron, Ohio, provided financial assistance to Jim Thorpe, great American athletic hero who is ill.

Because sulfur fires now constitute a special hazard as a result of the increased use of that material in industry, the Ansul Chemical Co., Marinette, Wisc., has issued a revised technical bulletin covering extinguishment of sulfur fires.

American Cyanamid Co., New York, N. Y., has reduced its price schedule on the recently introduced Aerosol OT-B wetting agent by about 15%. The new wetting agent is a concentrated quick-dissolving powder.

Goodrich Chemical has announced the appointment of Polymer Southern, Inc., Greenville, S. C., as distributors for the southeastern states of Goodrite TS-20, a new processing size for nylon, which was introduced last fall.

Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., is offering a technical bulletin on the uses of several Baker plasticizers with allyl starch. Formulations are given illustrating the efficient plasticization afforded by the use of the company products.

Development of a 3-inch diameter rubber-covered roll-type expander for textile plants which is designed to meet the stretch requirements of every fabric from light rayons to ducks or tire cord fabrics and rolled sheet plastics has been announced by Manhattan Rubber.

A new plant designed for the manufacture of Selectron, a polyester resin plastic, is under construction at Springdale, Penna., by the Paint Division of the Pittsburgh Plate Glass Co.

Short, accurate descriptions of more than 50 Bakelite and Vinylite plastics, their properties and their uses, are condensed into an eight-page ready reference file compiled by the Bakelite Co., a division of the Union Carbide and Carbon Co., 300 Madison Avenue, New York 17, N. Y.

A complete line of cabinet type instrument panels is listed and described in Bulletin "PI-2, recently released by the Wheelco Instruments Co., 847 W. Harrison St., Chicago 7, Ill.

Slomons Laboratories, 31-27 Thomson Ave., Long Island City 1, N. Y., is offering a new folder reviewing and briefly describing its line of adhesives, cements, lacquers, thinners, retarders, etc.

As a further service to its eastern rubber and plastics customers, National Rubber Machinery Co. has announced the opening of an eastern sales office in the Raymond Commerce Building, 1180 Raymond Blvd., Newark, N. J. The telephone number is Mitchell 2-1849.

Rocket motors for aircraft rockets are now being mass produced in Akron by Firestone. The rockets are being manufactured under a contract with the U. S. Navy Bureau of Ordnance.

Lang, Maxwell & Springer, Ltd., London, W.C. 2, England, has made available the 2nd Edition of a listing of "German Books on Chemical and Cognate Subjects Published 1939-1950." Copies are available from the company at 41 Neal St., London.

Shell Chemical Corp. has opened a new district sales office at 808 William-Oliver Building, Atlanta 1, Ga., under the direction of M. E. Ellison.

Industrial Products Co., Philadelphia, Penna., has introduced a new safety record sign designed to act as a constant reminder of days worked without a lost-time injury. The "IPCO Safety Scoreboard" is 20 inches wide by 30 inches high.

Eriez Manufacturing Co., Erie, Penna., has issued a new catalog describing the RCA Special Metal Detector, a protecting device designed for the inspection of thin strips of rubber and other materials. Ask for Catalog E-61.

A bulletin describing the "precision balanced" and "more grip, less slip" features built into the improved Condor V-Belts has been issued by the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J. Ask for Bulletin No. 6868-E.

As of September 1, 1951, all machinery, material and other assets of the Gasket Materials Corp., Middleton, Conn., were sold and transferred to the Detroit Gasket & Manufacturing Co.

Ray-Man "F" Conveyor Belt, recently developed with an engineered strength member which is claimed to offer several important advantages over conventional duck belts, is described in Bulletin No. 6915, issued by the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J.

The Textile Division of the U. S. Rubber Co. has opened a new yarn sales office at 300 West Adams St., Chicago, Ill., under the direction of John H. Shaw who has been in charge of the company's sales office in Utica, N. Y.

A new machine for wet abrasive blasting is described in a four-page bulletin just published by the American Wheelabrator & Equipment Corp., Mishawaka, Ind.

Hajoca Corp., Philadelphia, Penna., has been named a distributor of Uskon electrical radiant heating panels manufactured by U. S. Rubber.

ASTM, in cooperation with the Battelle Memorial Institute, is sponsoring the annual H. W. Gillett Memorial Lecture to be delivered annually at a meeting of the Society.

Extremely compact vacuum flasks for the storage of cold liquids, such as liquid oxygen and nitrogen, have been designed by scientists of the National Bureau of Standards for the U. S. Air Force.

Glyco Products Co., Inc., Brooklyn, N. Y., has announced that Acrawax C, its synthetic wax with the very high melting point of 140 to 142° C., has been greatly improved in color stability toward heat by an improved manufacturing process which has also made possible a reduction in cost.

Enrup Roller Skating Wheel

A new plastic wheel which promises to take the noise and slip out of roller skating has been developed jointly by the U. S. Rubber Co. and Fo-Mac Enterprises, Inc., 114 West Archer St., Tulsa, Okla. The new wheel is made of Enrup, the thermosetting plastic developed by U. S. Rubber. Skate wheels are presently made of wood or fiber. The new Enrup wheel, it is claimed, will wear 50% longer than wood and 25% longer than fiber. In addition, the new wheel is said to give a surer, tighter grip to the rink floor and reduces the danger of slipping during intricate jumps, spins and turns. The wheel was developed by Vernon Fowlkes, a one-time professional skating instructor, and U. S. Rubber engineers. A unique advantage of the new wheel is that it reduces the need for periodic grinding and refinishing of wheels on rental skates. The Enrup wheel wears down without developing flat spots as do wood and fiber types. This is because Enrup has no grain like wood or fiber. In addition, it will neither chip nor split, U. S. Rubber states.

Neoprene Package Identification

The Rubber Chemicals Department of E. I. du Pont de Nemours & Co., Inc., has inaugurated a new package identification system for neoprene. Besides the normal printed identification, the different types of neoprene will be identified by colored tapes on the ends of the bags. Following is the key for the various types:

Tape Color	*Represents*
Blue	Type GN
Red	Type GNA
Orange	Type AC
Yellow	Type S
Purple	Type CG
Black	Type RT
Green	Type W
Natural (kraft)	All Other Types

Delco Plans $8,000,000 Plant

Delco Products Division of the General Motors Corp. is planning the construction of a large plant at Van Buren, Ohio. Although the cost has not been disclosed, it is understood to be in the vicinity of $8,000,000. Delco expects to start construction as soon as weather and material reserves permit. The first unit of the plant will house production facilities for the manufacture of landing gear struts urgently needed in the defense program. Ultimately, General Motors expects to transfer its entire Delco Division from Dayton, Ohio, to the new Van Buren plant, company spokesmen said.

Parker Appliance Co., Cleveland, Ohio, has announced a new formulation of its synthetic O-ring molding Compound 90 which supplies properties exceeding requirements of Army Ordnance Specifications.

Suntone White VSI, a rotogravure printing color for vinyl film, is being produced by the Warwick Chemical Co., a division of the Sun Chemical Corp., at Long Island City I, N. Y.

Goodyear Pliotherm Foot Warmer

Goodyear Tire & Rubber Co. has developed a new conductive foot warmer which actually builds up heat energy within itself upon application of electrical current. The foot warmer, which has been designed to develop a temperature as high

as 100° F., is a novel application of the company's Pliotherm, long used as an anti-icing material for propellers and leading edges of airplane surfaces, and as drying blankets in the printed fabric industry. To be made in a wide range of colors, the foot warmer can be plugged into any convenient outlet, and can be moved from place to place without difficulty. The photograph above shows the foot-warmer as it could be used in an office.

Arwax Production Doubled

American Resinous Chemicals Corp., Peabody, Mass., has announced that new production facilities have made available for prompt shipment all Arwax concentrates. Arwaxes are concentrates of synthetic rubbers and resins in paraffin and microcrystalline wax. They are used to improve the adhesion, flexibility, heat-seal anti-blocking and gloss properties of paraffin and microcrystalline waxes. Improved tensile strength, grease-proofness, tack when molten and resistance to water vapor transmission are also obtained. Butyl rubber, Vistanex, S-Polymer and polyethylene waxes are currently offered. The corporation is also prepared to compound special blends to meet specific requirements.

Wittenberg Joins General Tire

Robert B. Wittenberg has joined the General Tire & Rubber Co., Akron, Ohio, as manager of its Chemical Division. Mr. Wittenberg comes to General Tire from the J. T. Baker Chemical Co., Phillipsburg, N. J., with which he was associated for the last two years. Since March of 1951, Mr. Wittenberg had served as sales manager of J. T. Baker's Industrial Chemical Division. Previously, he was associated with the International Minerals & Chemical Corp., Chicago, Ill.

Randall Duster Names Agent

The Randall Duster Corporation, 82 Beekman St., New York 7, N. Y., has announced the appointment of the National Rubber Machinery Co., of Akron, Ohio, as exclusive selling agents and distributors for the Randall Duster in the states of Ohio, Michigan, Indiana, Illinois, Wisconsin and the Province of Ontario. E. E. Heston will be in charge of activities in this territory. Sales for Pennsylvania, New Jersey and New England will continue to be handled from the New York office for the time being. The Randall Duster is reported to be doing a creditable job not only in the rubber and plastics fields, but also in the Fiberglas insulating materials field and the mattress, upholstery, rug cushion, cutting wheel and paper coating fields.

Grasshopper Motorcycle Tire

Newest development in motorcycle tires by the Goodyear Tire & Rubber Co. is a new unit designed for both on and off-the-road travel and for use in any type of weather. Termed the "Grasshopper," the new tire has an extremely rugged tread. According to Goodyear, the tread surface is composed of self-cleaning blocks which give positive traction in mud, snow, through grass, over clay or on paved roads. Already in wide use in England, the Grasshopper tire has proved especially popular there in sporting events such as hill climbs, field meets and speed tests on any surface. The new tire is made in two sizes, 5.00-16 and 3.25-19. The Grasshopper has replaced the firm's DeLuxe All-Weather unit in the 5.00-16 size only, the latter unit having been discontinued.

Propylene Glycol Monoricinoleate

Baker Castor Oil Co., New York, N. Y., has announced the production in commercial volume of propylene glycol monoricinoleate, which will be marketed under the trade name "Flexricin 9." Modifications of the ester are also manufactured as "Flexricin 10," and offer price advantage. Both esters are available in regular and cosmetic grades. These chemical derivatives find application as plasticizers for synthetic resins, as surface active agents, etc. Samples and data sheets are available from the company on request.

Considers International Diplomas

In order that students and others engaged in the rubber manufacturing industry in various countries should work to a common syllabus leading to a diploma mutually recognized, the Institution of the Rubber Industry, London, England, is presently considering the establishment of internationally-recognized qualifications. Norway, Sweden, Denmark, Holland, Belgium and Switzerland have already endorsed the plan, while France, Italy, Germany and Austria have been invited to participate.

Naugatuck Chemical Appointments

Clayton F. Ruebensaal, formerly technical director, plastics and resins, for the Naugatuck Chemical Division of the U. S. Rubber Co., has been named to the newly-created position of commercial development manager of the division. At the same time, Dr. D. Lorin Schoene, formerly manager of organic research for the division, was named to succeed Mr. Ruebensaal as manager of plastics development. In his new position, Mr. Ruebensaal will concentrate on developing new commercial outlets for Naugatuck's fundamental research. A graduate of the Case Institute of Technology, Mr. Ruebensaal was one of the organizers of the Chemical Division of the Glenn L. Martin Co., and was, in large part, responsible for the initial research, development and production of Marvinol polyvinyl chloride resins. He joined Naugatuck in 1949 when U. S. Rubber purchased the assets of Martin's Chemical Division. Dr. Schoene, in his new capacity, will assume direction of all applied research, process development and technical sales service activities pertaining to Kralastic molding powders, Vibrin polyester resins, Marvinol vinyl resins and other Naugatuck plastics. A Doctor of Philosophy in chemistry from Iowa State College, Dr. Schoene joined U. S. Rubber in 1939 as a chemist in its general laboratories in Passaic, N. J. He joined Naugatuck in 1942 as a research chemist and was named manager of organic research in 1947.

FMC Sponsors Prize Contest

First Machinery Corp., New York, N. Y., has announced a $1,500 prize contest open to any person connected with the chemical and allied industries in order to stimulate interest in good used equipment. Started in November, 1951, the contest will run to October, 1952. The awards are $100 a month for the best statement on the subject, "My Happiest Experience with Used Equipment." In addition, the corporation will award a grand prize of $300 for the best article of the year. The judges are Walter J. Murphy, editor of American Chemical Society publications; T. R. Olive, of the editorial staff of McGraw-Hill publications, and Fred R. Firstenberg, president of First Machinery. All entries are to be sent to Contest Editor, First Machinery Corp., 157 Hudson St., New York 13, N. Y.

Forms Chemical Sales Business

John P. Harris, who recently ended a long career with the Industrial Chemical Sales Division of the West Virginia Pulp and Paper Co. when he reached retirement age, now is operating his own chemical sales business at 1791 Howard St., Chicago, Ill. The firm handles both powdered and granular activated carbons, precipitated calcium carbonates and filtration materials. Mr. Harris' wife, Mildred James Harris, is vice-president of the new corporation, and his son, James T. Harris, is secretary. John Harris retired as manager of the Chicago district office of the Industrial Chemical Sales Division on December 1, 1951.

Taylor Instrument Personnel

Raymond E. Olson, newly-elected president of the Taylor Instrument Companies, has announced several major changes in the supervision of the Sales Department. Frank S. Ward, since 1945 industrial sales manager, has been named to succeed Mr. Olson as general sales manager. Albert J. Fleig, formerly divisional sales manager in charge of sales to the chemical, petroleum and canning industries, has been named industrial sales manager succeeding Mr. Ward. George E. Heller, associated with the firm since 1935, has been made manager of a new industrial sales division handling products sold to the chemical industry. Richard N. Pond, with the company since 1941, has been named a divisional sales manager handling sales of industrial instrumentation to the petroleum and the canning industries.

Offers New Line of Plastisols

The Latex Division of the Rubber Corporation of America, Brooklyn, N. Y., is offering a new line of "RC Plastisols" for slush casting, dipping of wire baskets and metal parts and other applications. The plastisols are formulated to meet the most stringent heat and light stability requirements, the company states. Rigid production controls insure uniform quality, extended storage life and stable viscosities. The Rubber Corporation of America maintains a fully equipped laboratory and a free consulting service which is available for the development of plastisols to meet customer requirements.

Offers New Recapping Stock

Seiberling Rubber Co., Akron, Ohio, has announced that a natural rubber, cut-resistant treading stock is now available for its recapping customers who need that type material. The hard tread stock will be made in natural rubber only since cuts or tears in natural rubber do not tend to enlarge or extend as they do in synthetic rubber, the company states. This hard tread stock is particularly suitable for off-the-road service where cutting is a major problem, as in mining, logging and construction work. Seiberling uses the cut-resistant natural rubber in its Traction Lug hard tread tires.

FINANCIAL NEWS

Armstrong Rubber Co.

Year Ended September 30: Net income of $2,832,393, which is equal to $7.28 a share on net sales of $50,325,336, compared with $2,423,542, or $6.34 a share on sales of $42,169,263 in the previous fiscal year.

Plastic Wire & Cable Corp.

Year to September 29: Net profit of $269,524, which is equal to $2.71 a share on net sales of $6,060,252, compared with $68,112, or 68c a share, on sales of $2,920,320 in the previous fiscal year.

Tax Amortization Plan Summarized

The Defense Production Administration has released a summary of the Certificates of Necessity which have been granted industry for accelerated tax amortization. The list which follows covers Certificates of Necessity approved through October 19, 1951:

Synthetic Rubber—5 Certificates were approved involving a proposed investment of $11,680,000 of which 66.5%, or $7,771,000, was granted.

Tires and Tubes—1 Certificate was approved involving a proposed investment of $106,000 of which 75.5%, or $80,000, was granted.

Reclaimed Rubber—9 Certificates were approved calling for a proposed investment of $6,817,000 of which 64.6%, or $4,407,000 was granted.

Rubber Industries—not elsewhere classified—28 Certificates were approved calling for a proposed investment of $11,547,000 of which 72.8% or $8,407,000, was granted.

Insulated Wire and Cable—19 Certificates were approved involving a proposed investment of $5,971,000 of which 42.1%, or $2,516,000, was granted.

Stauffer Announces New Plant

Stauffer Chemical Co., has announced plans to construct a plant at Louisville, Ky., for the production of anhydrous hydrogen chloride, carbon tetrachloride and perchlorethylene. The process to be used, developed by Stauffer's chemists and engineers, consists of chlorinating a hydrocarbon gas. By varying the process slightly, other organic products may be obtained in addition to those mentioned. The hydrogen chloride will be used locally in the manufacture of neoprene. The carbon tetrachloride will be used in the manufacture of Freon for refrigeration, aerosols and other purposes. The plant site chosen by Stauffer near the Ohio river will accommodate not only the present program, but also expansion into the manufacture of other chemicals as the need for them develops. This will be the seventh new plant built by Stauffer since World War II, not including several major plant expansions.

Spiratube Flexible Fabric Tubing

Flexible Tubing Corp., Guilford, Conn., has developed "Spiratube," a new vinyl-coated flexible fabric tubing. Designed initially as ventilation tubing for the U. S. Navy, the product is easily adapted to the conducting of air and other gases, many solids, and liquids at low pressure, all under a variety of service conditions. The basic patented construction principle consists of preformed, continuous, spring wire ribbing, which is overlapped with spirally wound woven fabric of several alternate types. After fabrication, the tubing is coated with Geon latex. Spiratube's light weight and accordion-like retractability are said to make handling or shipping easy. It is non-kinkable and will not collapse under average fan suction pressure. In addition, the tubing is abrasion resistant and gives inertness to chemicals and oils.

IRRB Takes Action on TCR

According to the International Rubber Research Board, London, England, the present world output of technically classified rubber is somewhat more than 20,000 tons a year. This tonnage, however, is almost entirely No. 1 and No. 1X Ribbed Smoked Sheet. Therefore, the board has adopted a special resolution encouraging the production of lower grade rubber in the lower classes. The resolution reads as follows: "The IRRB, being aware of the increasing interest in technically classified natural rubber among consumers, welcomes the steady progress in evolving and developing TC rubber during 1951. They wish, however, to point out that the ultimate success of the scheme depends on including most of the RMA grades, and on substantially increasing the supplies on the world market. It is realized that this expansion will require appreciable expenditure by producers on test-stations, and some improvement in present arrangements for obtaining a uniform product, such as blending of field latex prior to coagulation and of solid rubber during the packing of bales, or during the remilling process, will be indispensable." IRRB states that approximately 500 tons of technically classified No. 1 RSS were shipped to the United States in 1951.

U. S. Rubber Arranges For Loan

U. S. Rubber Co. has nearly completed arrangements for the private placement of a long-term loan of $50,000,000. The loan, with interest at 3¼%, will be due January 1, 1982, and will have an average life of a little over 24 years unless earlier payment provisions are exercised. The regular sinking fund payments will fit in conveniently with the company's funded debt retirement schedule since payments on this loan will follow the completion of sinking fund requirements on each of the presently outstanding loans. The $50,000,000 may be borrowed during 1952 in installments as required, with a stand-by fee until borrowed. It is anticipated that the money will be needed for the rebuilding of normal inventories, other working capital relating to defense business, and for miscellaneous capital additions.

Humidity-Controlled V-Belt Plant

Said to be the only operation of its kind in the rubber industry, an entire factory devoted to rubber V-belt manufacture at the B. F. Goodrich Co., Akron, Ohio, is humidity-controlled. A newly-built plant, in effect, transforms the entire factory into a giant laboratory. The area is sealed from all other operations to maintain a constant amount of moisture in the air. Goodrich engineers say the reason for the unique plant layout is the tendency of rayon and other fibers and fabrics to absorb moisture. Where moisture content of the air varies from day to day, belt fibers absorb different amounts of moisture during manufacture. Such belts shrink or stretch unequally when in storage or in use, and do not match each other in length when used in sets. Control of humidity at the factory eliminates this problem.

VINYL SPECIALTIES

Colorful Vion plastic Christmas and other decorations, which stick to glossy surfaces without the use of tape, glue, water, or any adhesive, are being made of Geon polyvinyl plastic by the Flexon Products Corp., New York, N. Y.

A new combination cold and hot pack containing a special chemical solution sealed in a pack made of durable Vinylite plastic is being manufactured by Duo-Pac, Inc., 220 West 42nd St., New York 18, N. Y. The pack may be warmed in hot water or cooled in the refrigerator and will retain heat or cold for about 30 minutes.

Made of Geon polyvinyl plastic, a new water stop is being used at the Guayabo Hydroelectric Project, now under construction in El Salvador, Central America. The plastic joint seal, extruded by Perfex Plastics, Inc., Chicago, Ill., is a central rib backed by U-shaped grooves and weighs 2.02 pounds per foot.

General Dyestuff Renames Antara

Antara Products, a division of the General Dyestuffs Corp., 435 Hudson St., New York 14, N. Y., in furtherance of a $20,000,000 expansion program in the field of surfactants, intermediates, acetylene chemicals and allied products, will be known as Antara Chemicals after December 1. Antara, which coordinates sales and services of 11 acetylene chemicals, intermediates and allied products made by the General Aniline & Film Corp., was formed on October 1, 1950, as a merger between the original Antara Products, then a division of General Aniline, and the Organic Chemicals Division of GDC. The Technical Division of Antara Chemicals has been augmented and coordinated to function exclusively at the company's New York address.

Nevsolv Petroleum Solvents

Neville Co., Pittsburgh 25, Penna., has announced the development of a new group of aromatic petroleum solvents called "Nevsolv". The new solvents are available in a number of distillation ranges from low to high boiling. They are manufactured to rigid specifications, insuring high solvent power, constant evaporation rates and negligible residue. In addition to the standard distillation ranges, the company invites inquiry on special fractions to meet particular requirements.

Kemysal Anti-Fungus Agent

Flax and Fibre Institute of America, 6423 North Newgard Avenue, Chicago 26, Ill., has announced the development of "Kemysal," an anti-fungus, anti-mildew and anti-deterioration agent. The product is described as a penetrator of fiber, fabric and other materials, rather than as a coating. Processing of fibers, fabrics, etc., with Kemysal is said to give these goods anti-fungus, anti-mildew and anti-deterioration qualities permanently. Kemysal is said to be economical to use.

Upholds Bata Shoe Decision

The Appellate Division of the New York State Supreme Court by a three-to-two vote recently awarded stock interests in the Bata Shoe Co. to the widow and son of the founder who was killed in an airplane accident in July, 1932. The court, affirming a previous decision, wrote three separate opinions. The litigation involved the ownership of 826 shares of stock of the Leader, A.G., principal holding company of the Bata Shoe empire, which was found in a safe deposit box maintained by the late Frank Muska in the vaults of the Chase Safe Deposit Co. Neither the administrator of the Muska estate or the deposit company asserted claims of ownership. Marie Bata, the widow, and her son Thomas, heirs of the founder and "universal successors" under the Czechoslovakian law, brought a replevin action in 1947 in behalf of the estate. The decedent's half-brother, however, asserted ownership under a purported verbal contract entered with his brother in May, 1931, for the purchase of the latter's business properties, including the Leader shares.

J. T. Baker Expansion Program

J. T. Baker Chemical Co. will shortly begin operations at its new unit process plant at Phillipsburg, N. J., as part of a $3,000,000 expansion and modernization program. According to company officials, the new plant will boost production of many inorganic chemicals used in the rubber and other industries. The new plant utilizes closed automatic equipment and other innovations. Pilot plant operations, where processes are perfected and controlled prior to mass production, have been greatly enlarged and improved upon, the company said.

Presentation of Technical Data

An interesting booklet entitled "Presentation of Technical Information," based on a talk made by F. C. Jennings, has been made available by the Institution of the Rubber Industry (of England). The booklet describes methods by which reports, documents, specifications, processes, papers, etc., can best be prepared. Some of the devices used by speakers and writers to secure the reader's or listener's attention and to obtain clarity and simplicity are described. Copies of the booklet may be secured without charge on request to the Institution.

F-B Acquires Consolidated Stock

Farrel-Birmingham Co., Inc., of Ansonia, Conn., has acquired the common stock of the Consolidated Machine Tool Corp., Rochester, N. Y., part of the consideration being securities of the Farrel-Birmingham Co. The Consolidated plant will be operated as a subsidiary of Farrel-Birmingham, and will continue production of its lines of machine tools. Arthur H. Ingle will remain as president of Consolidated and will become a director of Farrel-Birmingham.

CANADIAN NEWS

General Tire & Rubber Co. of Canada, Ltd., currently in the midst of its biggest expansion program, will construct a $600,000 addition to its recently acquired Joseph Stokes Rubber Co. plant at Welland, Ont. The extended facilities will be for the first large scale production in Canada of glass rim channel, a combination rubber-felt-metal stripping that goes around automobile windows.

The company also plans action on its 26-acre property at Sarnia, Ont., which it acquired last year. Plans are to produce a broad range of mechanical rubber goods, including sponge rubber products, in a new plant to be constructed on the site. Estimates on the plant cost have run as high as $5,000,000.

St. Maurice Chemicals, Ltd. of Montreal, Que., has been selected by the Heyden Chemical Corp. and Shawinigan Water & Power Co. of Montreal as the Canadian corporation to carry out their joint program to build a $2,000,000 plant at Varennes, Que. The new plant will manufacture 30,000,000 pounds of formaldehyde and 3,000,000 pounds of pentaerythritol annually.

Survey work is now under way and construction of the new plant, covering 30 acres, is expected to be started this spring. John P. Remensnyder, president of Heyden Chemical, has been named chairman of the board of St. Maurice Chemicals, while V. G. Bartram, president of Shawinigan Water & Power, has been named president of St. Maurice Chemicals.

The joint Heyden-Shawinigan enterprise is adopting the name and revised charter of a company which was formed in 1942 as an associate of Shawinigan Chemicals. The head office of St. Maurice Chemicals, Ltd., will be in the Shawinigan Building, Montreal.

The first company-financed pension plan negotiated by the CIO-CCL United Rubber Workers in Canada has been obtained at the Bakelite Co., Ltd., Belleville, Ont. According to the union, the plan provides $100 a month at the age of 65 after 25 years' service, or $60 at 65 after 15 years' service. The plan also contains a disability clause which gives an employee $50 a month after 15 years' service regardless of age. This sum continues until he reaches 65 when he becomes entitled to the $100.

A general increase of 18c an hour; a 24c boost to starting rates, and a 1c an hour increase in shift bonuses, raising the afternoon rate to 6c and the night differential to 8c, are other highlights of the agreement.

Canadian Industries, Ltd., of Montreal, Que., has announced plans for building Canada's first plant for the manufacture of polyethylene at Edmonton, Alberta, at a cost of about $13,000,000. Construction is scheduled to begin this spring with production slated to start late in 1953. The Edmonton plant will employ more than 200 persons and will be located on a 300-acre site. Operations will require about 10,000,000 cubic feet of natural gas, 8,000,000 gallons of water and 35,000 kilowatt-hours of electricity daily. The latest project is the second for Canadian Industries in Alberta. It now has under construction a commercial explosives works near Calgary. This plant is scheduled to start operations this spring.

As reported in recent issues of RUBBER AGE, the Mailman Corp. of Montreal, Que., has acquired the manufacturing facilities, finished goods inventories, and all Canadian assets of Cambridge Rubber, Ltd. Cambridge Rubber maintained its Canadian plant at St. Remi de Napierville, Que. Mailman has now arranged a long-term licensing program for Canada on certain Cambridge patents and trade marks including the "Tred-Lite" process. Mailman will also continue working arrangements on designs and patterns with the Cambridge Rubber Co., Cambridge, Mass. The head office of Cambridge Rubber in Canada has been moved to 4026 St. Catherine St. West, Montreal, Que.

Polymer Corp. has taken over the management of Canadian Synthetic Rubber, Ltd., effective January 1. According to J. D. Barrington, Polymer president, the move was contemplated when both companies began operations. Canadian Synthetic was formed by Firestone, Goodrich, Goodyear and the Dominion Rubber Co. when Polymer Corp., owned by the Canadian government, was established. Canadian Synthetic is now operating under the Polymer Corp. name.

Imports of natural rubber into Canada in the first nine months of 1951 were 82,789,739 pounds, compared with the 71,206,697 pounds imported in the first nine months of the preceding year. The approximate price of natural rubber, No. 1 RSS, landed Canadian seaport, during November, 1951, was 50c (Canadian) a pound. On October 30, 1951, the price was 54¾c.

Dunlop Tire & Rubber Goods Co., Ltd., has announced that a dividend of 2½% has been declared on its 5% cumulative redeemable first preference shares for the half year ending December 31, 1951. The dividend was payable on December 31 to shareholders of record on December 17.

Goodyear Tire & Rubber Co. of Canada, Ltd., has announced an expansion program at its New Toronto, Ont., plant which will cost approximately $5,000,000. Company officials stated that ground has already been broken for a new addition to the present tire plant. This building will allow for the enlargement of present facilities and for storage and shipping space. Modifications are being made to the present building for the housing of modern stock preparation methods. The expanded plant, when working to capacity, will provide employment for 400 additional persons. It is hoped that increases in production will begin in the early part of 1953 when the buildings will be completed.

The new facilities will add 142,000 square feet of floor space to the present plant and will be joined to the existing buildings by means of steel and wood bridges. Two stories in height, the new construction will be of steel and brick. Floor space will then cover 26 acres in the enlarged New Toronto plant.

LOS ANGELES NEWS

The Christmas Party of the Los Angeles Rubber Group, held on December 7 at the Los Angeles Breakfast Club, featured an election of officers for the 1952 season. Members elected to office include: *Chairman*, R. L. Short (Kirkhill Rubber); *Associate Chairman*, D. C. Maddy (Harwick Standard); *Vice-Chairman*, L. E. Budnick (Ohio Rubber); *Treasurer*, F. C. Johnston (Caram Mfg.); *Secretary*, R. E. Bitter (Goodrich Chemical).

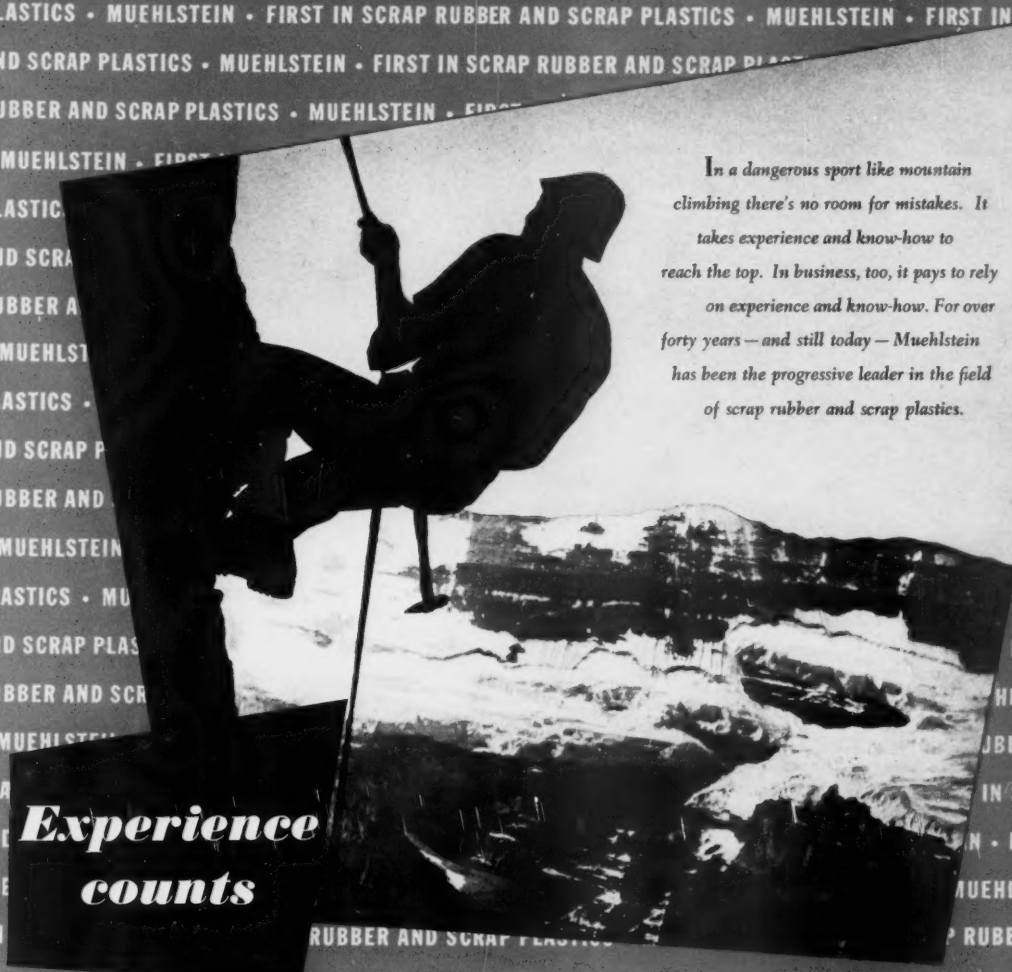
The 1952 board of directors consists of the abovementioned officers along with R. D. Abbott, retiring chairman, and the following newly-elected members: George Miller (W. J. Voit Rubber), Dixon Sheppard (Goodyear), and Charles Kuhn (Master Processing).

Approximately 400 members, their wives and guests attended the party. Every lady present received a leather-covered compact as a table favor. Mr. Abbott was presented with a past-chairman certificate and received a silver cigarette box from the group.

The Society of Aircraft Materials and Process Engineers met on December 17 at Scully's Restaurant in Los Angeles. The subject for the meeting was "Rubber (Natural and Synthetic) in the Aircraft Industry." Robert Janssen (North American Aviation) acted as moderator for the session. Speakers at the meeting were: Willys G. Blunt (Kirkhill Rubber) Charles Miller (Northrop Aircraft) Robert Pelzell (Douglas Aircraft), and Fred Woerner (Los Angeles Standard Rubber).

The meeting featured a panel discussion on the types of polymers used, applications, fabrication problems, specifications, test methods, and new developments.

Short accurate descriptions of more than 50 Bakelite and Vinylite plastics, their properties and their uses, are condensed into an eight-page reference file compiled by the Bakelite Co., a division of the Union Carbide and Carbon Co., 300 Madison Avenue, New York 17, N. Y.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OBITUARIES

James A. Rafferty

James A. Rafferty, vice-president and a director of the Union Carbide and Carbon Corp., died on December 19 at Fort Lauderdale, Fla., after a brief illness. He was 65 years old. A pioneer in the development of the synthetic organic chemical industry in the United States, Mr. Rafferty was executive official in charge of the operations of Union Carbide for the government's synthetic rubber and atomic energy programs.

In 1940, before the United States supply of natural rubber was cut off by the Japanese, Mr. Rafferty and his associates were asked to find a quick source of huge quantities of butadiene and styrene to make synthetic rubber. By selecting a process to make butadiene from alcohol, his company, with him as coordinator, was able to ship such large quantities of butadiene that by August, 1944, the crisis in rubber was said to have passed. The Chemical and Engineering Award was given to his concern in 1943 in recognition of outstanding work under Mr. Rafferty's direction in the synthetic rubber program.

He was elected a vice-president of Carbide and Carbon Chemicals Corporation in 1924. The next year he was elected a vice-president of the Linde Air Products Company. In 1929 he was made president of Carbide and Carbon Chemicals Corporation, and in 1939 he was elected president of Bakelite Corporation. He became chairman of the board of both of the latter companies in 1944.

Mr. Rafferty was named vice-president of Union Carbide and Carbon Corporation in 1938. In 1941 he was made a director and in 1944 a member of the executive committee. A trustee of Illinois Institute of Technology, he was a member of the American Chemical Society. His clubs included the Chemists, Uptown, Union League, Chicago and Westchester Country. Mr. Rafferty is survived by his wife, two sons and four daughters.

Arthur B. Ray

Dr. Arthur B. Ray, sales manager of the Special Products Division, Carbide and Carbon Chemicals Co., a division of the Union Carbide and Carbon Corp., New York, N. Y., died suddenly on December 24 at Port Washington, N. Y. He was 62 years old. Dr. Ray was considered the country's foremost authority on activated carbon and was the first to develop a process for producing activated carbon from coconut shells, a factor of great importance to the military services. Dr. Ray first joined Union Carbide in 1919. Born in Leaksville, N. C., he was graduated from Wake Forest College in 1910. He received his master's degree from Wake Forest in 1911 and his Ph. D. from Cornell University in 1916. His wife and two daughters survive.

Russell A. Firestone

Russell A. Firestone, second son of the late Harvey S. Firestone, and a director since 1932 of the Firestone Tire & Rubber Co., died on December 12 at his home in New York City. He was 50 years old.

Mr. Firestone was born on December 3, 1901, in Akron, Ohio, and attended grammar school there. He also attended the Asheville (N. C.) School and Phillips Exeter Academy, and was graduated from Princeton University in the class of '24. After graduation, he joined his father's company, and in 1932, the same year he was made a director, became general manager of the Mechanical Rubber Goods Division, a position he held until 1939. In 1942, Mr. Firestone was named general manager of the Nebraska Defense Corp., a Firestone subsidiary, and supervised construction and first operation of the bomb loading plant near Omaha. He returned to Akron in 1943 as assistant treasurer of the parent company.

Mr. Firestone was a vice-president of the Firestone Bank, and in 1944 and 1945 was a vice-president of the National Victory Garden Institute. He was interested in the work of the National 4H Clubs, the Future Farmers of America, and other youth movements. A racing enthusiast and a breeder of thoroughbred horses, he also was a director of the Metropolitan Jockey Club, the Hialeah Race Track and the Saratoga Association.

He is survived by his wife, two sons, his mother and four brothers, all of whom are associated in the business their father founded. Funeral services were held on December 14 at Harbel Manor, the home of Mr. Firestone's mother, in Akron.

Maurice E. Nye

Maurice Eugene Nye, vice-president and part owner of the Nye Rubber Co., Barberton, Ohio, died of a heart attack on December 12. He was 46 years old. Mr. Nye was a life resident of Akron and formerly was employed by the National Rubber Machinery Co. He was a member of the F. & A. M. Services were held on December 15 with cremation in Cleveland, Ohio. Mr. Nye is survived by his wife, two sons, and a daughter, and by his brother Willard, secretary of the Nye Rubber Co.

James F. Fenning

James F. Fenning, factory manager of the Raybestos Division of Raybestos-Manhattan, Inc., at Stratford, Conn., died at his home in Fairfield, Conn., on December 17. He was 47 years old. Mr. Fenning had been associated with the company for 22 years and had served as factory manager at Stratford since 1944. His wife and two daughters survive.

John K. Hough

John K. "Jake" Hough, advertising director of the Goodyear Tire & Rubber Co. since 1937, died on December 29 following a three weeks' illness. He was 60 years old. Born in Erie, Penna., on March 12, 1891, Mr. Hough graduated from Amherst College and joined Goodyear in 1914 in the Dealer Sales Department at Akron. He subsequently served in Jacksonville, Fla., as a salesman and as district sales supervisor before returning to Akron to become manager of tube sales. Mr. Hough's next assignment was in Boston as service manager, then, in 1919, he was named manager of auto tire sales at Los Angeles. Seven years later he was appointed sales manager of Goodyear-California, serving in that capacity until 1934, when he returned to Akron to become assistant manager of tire sales. Next assignment for Mr. Hough was in England where he was made assistant managing director of the Goodyear Tyre & Rubber Co. of Great Britain, Ltd., in 1935 and, the following year, managing director. He returned to Akron in 1937 as advertising director. Mr. Hough was a member of Phi Kappa Psi and a 32nd degree Mason and a past president of both the Akron Rotary Club and the Akron Advertising Club. His wife, a son and two daughters survive.

James F. Mackey

James Fields Mackey, manager of product evaluation for the Sid Richardson Carbon Co., Fort Worth, Texas, died of poliomyelitis on November 27. He was 34 years old. Mr. Mackey received his bachelor of chemistry degree from Northwestern University in 1939, and for several years thereafter was employed with the Dryden Rubber Division of the Sheller Manufacturing Co. and the Printing Arts Research Laboratories, both of Chicago, Ill. Joining the Continental Carbon Co. in 1941, he rapidly rose to the position of chief chemist. Mr. Mackey held that position until he joined Sid Richardson in March, 1951. Mr. Mackey was noted for his contributions to a better understanding of the behavior of carbon black in GR-I and reclaimed rubber and also of the effect of carbon black on the electrical conductivity of tire treads. He was a member of many technical and fraternal organizations.

John F. Segelcke

John F. Segelcke, sales manager of the Organic Acids and Plasticizers Department, Industrial Chemicals Division, American Cyanamid Co., died suddenly on December 1 at his home in Teaneck, N. J. Mr. Segelcke joined American Cyanamid in 1921. He attended Columbia and New York Universities and was a member of the Phthalic and Maleic Anhydride Industry Advisory Committee of the National Production Authority. He was also a member of the Synthetic Organic Chemical Manufacturers Association of the United States. He is survived by his wife.

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NEW EQUIPMENT

Taylor Transet Bi-Act Controller

A new, non-indicating, force-balance controller with only one-knob adjustment for two control responses has been introduced by the Taylor Instrument Companies, Rochester 1, N. Y. The Transet Bi-Act Controller, as it is called, is designed for applications where it is desirable to transmit the measured variable to some remote location. It is particularly adaptable to flow, liquid level or pressure applications requiring fast reset rates and broad throttling bands, or applications where derivative action is not essential. This new controller is another component part of the Taylor three-part Transet Control System which includes the Tri-Act Controller, Transaire Transmitters, and the miniature Transet Recorder for graphic panel installations.

View of the new Taylor Transet Bi-Act Controller.

The Bi-Act Controller incorporates several features which make it especially advantageous to many applications: (1) A new and simplified control circuit which pneumatically links proportional and automatic reset responses together; (2) One knob to adjust both proportional and automatic reset responses so that the processes can be brought to a stable condition with extreme ease; (3) Controller action can be changed quickly and easily without disturbing any piping connections; (4) An optional, plug-in type, leakless manifold provides a simple means for connecting or removing controller; (5) Rapid controller action is obtained by a large capacity booster air relay. (6) Built-in cut-off relay is provided on all Bi-Act Controllers so that they may be either panel or field mounted; (7) An inexpensive controller for those applications where derivative response is not required.

The controller measures only 7½ inches in over-all length and has a range of adjustment of 1 to 200% per minute. It is available with or without the manifold throttling range and automatic reset of 0 to 100 repeats bracket.

With the new multi-million dollar pigment expansion at the Barberton, Ohio Plant, Columbia-Southern now can supply Hi-Sil and Silene EF in greatly increased volume.

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SILENE EF—Precipitated hydrated calcium silicate; particle size .03 micron; 2.10 sp. gr. It imparts high modulus, good tensile, high tear and abrasion resistance.

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Thermoid Company, Trenton, New Jersey, depends on Martin All-Nylon Cure Wrapping Tape

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Looped edge • Natural color • Standard widths in stock ($1\frac{3}{4}$", 2", $2\frac{1}{4}$", $2\frac{1}{2}$", $2\frac{3}{4}$", $3\frac{5}{16}$", $3\frac{1}{2}$") • Special widths on request • Put-up, 72 yard rolls, or to order

Martin
All-Nylon Cure Wrapping Tape

Send for sample yardage today

MARTIN FABRICS CORPORATION
48 WEST 38TH STREET • NEW YORK 18, N. Y.

Sani-Dri Boot and Shoe Dryer

The development of a new Sani-Dri boot and shoe dryer has been announced by the Chicago Hardware Foundry Co., 3501 Commonwealth Ave., North Chicago, Ill. Developed to meet the need for a quick, economical method of drying boots and shoes this machine has many

uses in industries and municipalities. Drying is accomplished quickly with a 125 cubic foot per minute air stream heated by a 13.5 amp element with a 5300 BTU output. The boots are placed on the boot bracket over the metal tubes and drying is accomplished quickly by the heated air blowing into the boots. Complete protection to the machine is provided by a sensitive circuit breaker to protect the heating element from excessive overloading.

Tough?
SEE PAGE 412

RUBBER & PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

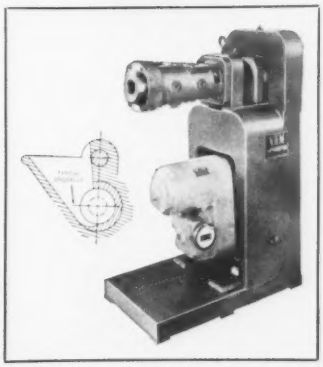
IN BUSINESS TO **NRM** REDUCE YOUR COSTS

New Extruder Occupies Minimum Floor Space

Newest addition to NRM's line of rubber extruders is the compact 1½" Standard Model. Specifically designed for experimental work, and well adapted to the production of small cross-section extrusions, the new machine occupies a floor space of only 4 square feet. Thus, it is ideal for use in the laboratory or in crowded production areas.

In addition to its compactness, the new extruder incorporates all of the outstanding features of the larger NRM machines. One of the most important of these is the undercut feed hopper (see sketch) which assures good hand feeding, or continuous strip feeding. With the under cut, the strip is not pinched off and a small bank of stock is maintained in the upper forward corner of the feed box. As a result, voids do not occur in the screw flights, the cylinder is evenly stuffed, and more uniform extrusions are obtained.

Other features of the new machine include: a heat-treated, hollow bored alloy



steel, single flight, double tipped screw; semi-steel cylinder with replaceable Xaloy liner and circulating type jackets; jacketed die adapter head; extra heavy bearing housing with oversize bearings; 3 H.P. Variable Speed Drive; and, NRM's fine workmanship throughout.

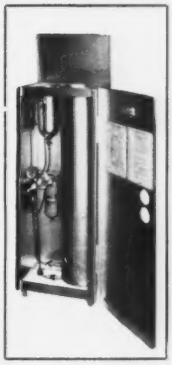
Write for more details!

Eastern Office Recently Opened

In order to provide better service to its Eastern customers, NRM recently opened a new sales office in the Raymond Commerce Building, Newark, New Jersey, Telephone: Mitchell 2-1849.

Managing the new office is Mr. E. R. Coddington, formerly of our Akron office, who has wide experience in rubber and plastics machinery. He will be happy to work with you on your processing problems.

NRM Now Handles Randall Duster In Midwest



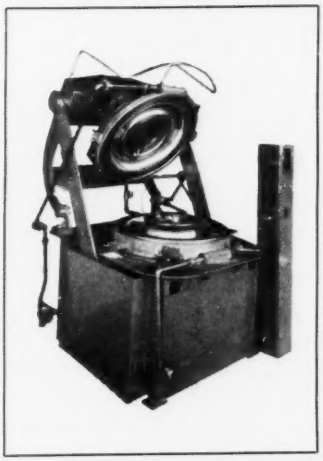
The Randall Duster is an unique, automatic dusting machine that is highly efficient, compact, portable, and simple to operate. Using clean, bone-dry air at extremely low pressures as the vehicle, the Randall Duster deposits powder particles, ranging in size from 70 mesh to micropulverized, separately and uniformly on the object being dusted. Because of the low pressures involved, only the correct amount of dust is deposited. Stray floating of powder is held to a minimum so that no recovery system is needed.

Simple in design, the Randall Duster has only one operating control, a pressure regulator which starts and stops the flow of powder and controls the density of deposit. The entering air is first cleaned and dried and then passed into the powder reservoir. Here, the powder is thoroughly aerated, or "fluidized", and sent through a venturimixer into a low pressure air stream. Then, the powder-laden air is brought to the point of application by flexible hose and deposited as a "dry fog".

The Randall Duster can be used in the processing of numerous rubber and plastic items to eliminate tack, blocking or sticking, or to impart desired slip and "hand". The machine is available in three sizes to handle dusting applications ranging from a few ounces up to 200 lbs. per hour.

Why not write for further information? Ask about a free demonstration.

NEW TUBE VULCANIZER HAS SIMPLIFIED DESIGN



By combining a simplified design with the latest in fabrication methods, NRM now offers a fully automatic tube vulcanizer (Model 45-14-110) of the highest quality at low initial cost. A standard geared head motor drive, minimum maintenance and ease of servicing are additional features.

The new unit is designed for 110,000 lb. loading and has capacity for molds of 45" OD and 14" overall thickness. Fine adjustments for mold thickness are made through a pinion and gear driving a nut over an adjusting screw on the center line of the mold platen.

A safety bar, which is readily hinged out of position for convenience in making mold changes is also provided.

Total weight of the press, less mold, is 3700 lbs. Overall dimensions are 4' wide, 5'2" deep, 7' high, when open.

Write, today, for further information!

NATIONAL RUBBER MACHINERY CO.

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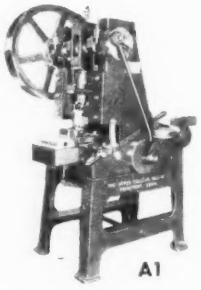
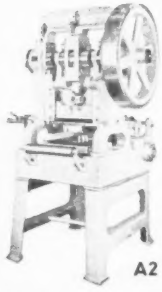
For MORE than Half a Century the name COULTER has meant MORE in higher quality cuttings . . . MORE IN GREATER PRODUCTION.

MODEL A-1
Cutting Heels at high speed production or short runs.

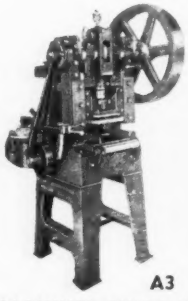

A1


A2

MODEL A-2
Cutting Multiple Heels, Half and Full Soles with stock grain.

MODEL A-3
Cutting Multiple Heels and Taps with or across stock grain.

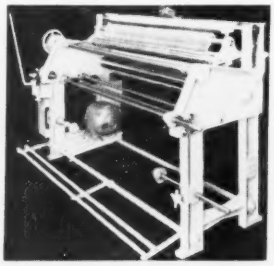
MODEL A-2s
(Not illustrated)
Cutting across grain of stock.


A3

COULTER PRODUCTION MACHINES SINCE 1896

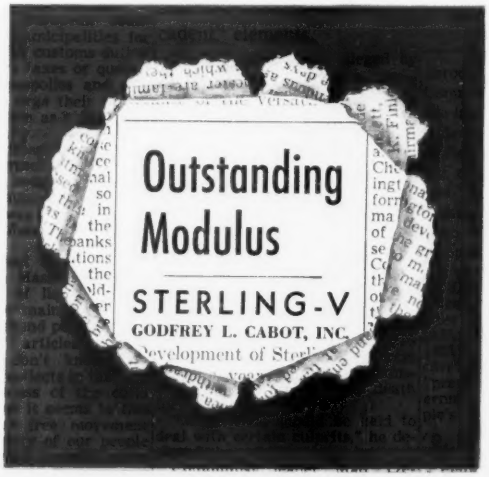
Center Tool Slitter-Rewinder

A versatile, fast-operating combination slitter-rewinder, which operates on a single shaft without interleaving or fusing, is currently being marketed by the Center Tool Manufacturing Co., 2707 West Van Buren St., Chicago 12, Ill. This precision-engineered, single rewind-slitter, with speeds up to 700 feet per minute,

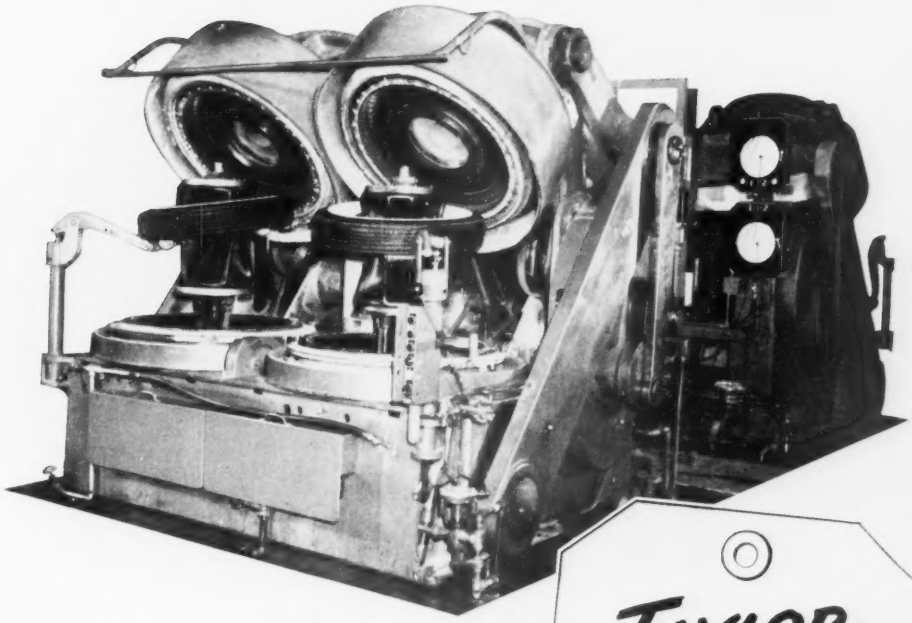


is said to operate perfectly with either razor blades or rotary cutters against a hardened steel roll. It is reported to be ideal for slitting rubber, cellophane, paper, gummed paper, Pliofilm, cloth, polyethylene, acetates and plastics (2 to 40 Ga.).

The machine will slit materials into rolls as narrow as ½-inch. All operations, including loading, threading, slitting and rewinding on rolls up to 18 inches in diameter, are done from the front of the machine. An extension of the supply shaft, which is non-removable and is connected with a universal joint, makes it possible for one man to load and operate. Other features include: removable blade holder, shock roll and compensating idler, traveling knife carriage assembly, quick-locking device on rewind shaft, variable speed foot treadle control, automatic paper rewind, tension control slip clutch for re-winding material from one supply roll to another or removing interleaved paper while slitting, hand-operated web guide, tension brake and carriage lock.



New Bag-O-Matic Press
saves space and time



THE NEW McNeil Bag-O-Matic Press combines these complicated operations into one simple process by: **(1)** automatically controlling time and temperature during curing **(2)** automatically "bagging" before vulcanizing and "debagging" after vulcanizing **(3)** and automatically opening the press. When delivered "Taylor-Equipped", as most of them are, they are masterminded by a Taylor FLEX-O-TIMER* Time Cycle Controller, two Taylor Double Duty FULSCOPE* Recording Controllers, and a Taylor Pressure Recorder.

FLEX-O-TIMER *(on back side)* automatically controls sequence and duration of all functions from closing to opening of press. Double Duty FULSCOPE Controllers *(right)* control press temperature and condensate removal in each cavity. Taylor Bi-Record Pressure Gage *(right, below)* records bag pressure to each press.

Whatever product you want to make, Taylor can control your process at low cost. To keep quality up and costs down, ask your Taylor Field Engineer! Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Registered Trade-Mark

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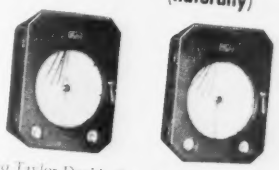
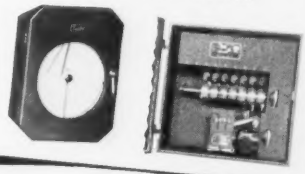
MEAN ACCURACY FIRST

TAYLOR-EQUIPPED
(naturally)



Two Taylor Double Duty FULSCOPE Recording Controllers *(above)* and Taylor Bi-Record Pressure Gage and Flex-O-Timer Time Cycle Controller *(below)* standard-equipped on the new McNeil Bag-O-Matic Press.



Fidelity

KNIT METHOD
OF HOSE REINFORCEMENT

offers you all these advantages . . .

- Yarn package 16 times larger
- 1/3 floor space
- 300% faster production
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- 90% less down time
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- 1/7 power required
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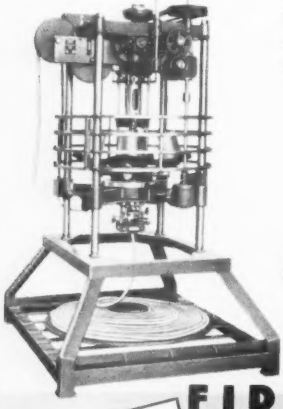
- Lower capital investment

The Fidelity Knitter uses untreated rayon, cotton, nylon, fiberglass, etc. as purchased, eliminating costly treating and rewinding equipment. Only 4 yarns to tend, save time and give consistent hose diameters. No drying time after knitting.

Results—a finer, more flexible hose with better adhesion, at a lower cost than braided hose.

Only Fidelity Knitters can give you all these advantages . . . advantages that put you ahead of competition and provide your customers with a better hose.

Why not write for new bulletin on single or double deck models. ACT NOW!



MODEL D-25
FIDELITY VERTICAL HOSE
REINFORCEMENT MACHINE

Manufacturers of intricate precision machinery since 1911.

FIDELITY MACHINE COMPANY INC.

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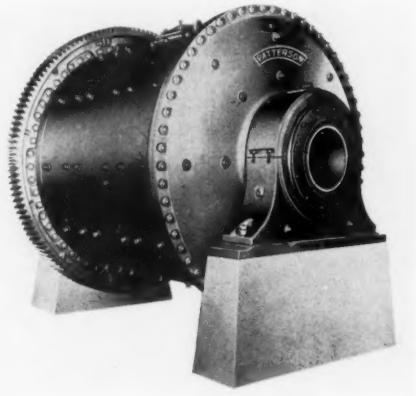
Heavy Duty Continuous Ball Mill

Development of a new heavy duty continuous ball or tube mill has been announced by the Patterson Foundry & Machine Company of East Liverpool, Ohio. Improved mechanical features of the mill are declared to insure economical and reliable continuous grinding op-



eration under the most severe conditions, with costly shutdowns being entirely eliminated and maintenance expense reduced to a minimum.

Adaptable to fine or coarse grinding, wet or dry grinding, open or closed circuit grinding, the new Patterson Continuous Mill may be used for pulverizing chemical raw materials, ceramic raw materials, minerals, and numerous finished products. The manufacturer states that the mill may be used to deliver a finished product, or it may be operated in conjunction with Patterson classifying equipment of various types. Hollow trunnions are provided for continuous feed and discharge of materials.

Tough?
SEE PAGE 412

for PRODUCTION and LAB TESTING

B. F. GOODRICH-CORD TENSION VIBRATOR

Quickly gives you dependable accurate, correlated comparison of your own production runs and a true comparison with competitive filaments.

For Cotton, Rayon and Nylon

Exclusive Manufacturers

FERRY MACHINE CO., KENT, OHIO

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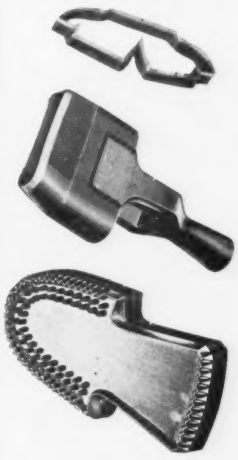

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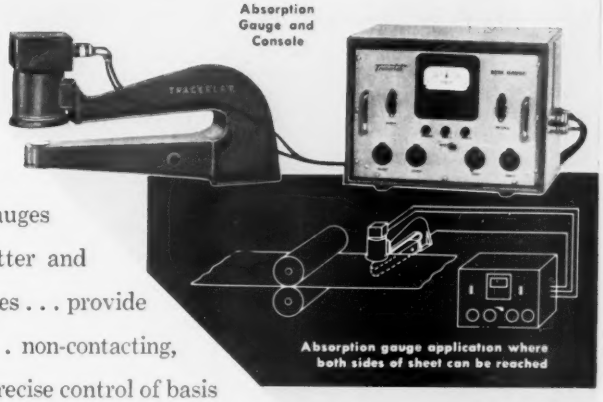
FOR RAW MATERIAL SAVINGS . . .
IMPROVED PRODUCT QUALITY



Tracerlab Beta Gauges . . . both Backscatter and Absorption types . . . provide low cost . . . non-contacting, highly precise control of basis weight or thickness in the process industries

FREE BOOKLET...
CONTAINING COMPLETE DETAILS AVAILABLE ON REQUEST. ASK FOR PAMPHLET BG-1X

Tracerlab
130 HIGH ST., BOSTON, MASS.

Surface Temperature Thermometer

A new surface temperature thermometer for the fast and accurate checking of rubber molds, plastic dies, etc., has been introduced by the Pacific Transducer Co., 11921 West Pico Blvd., Los Angeles 64, Calif. The instrument may be quickly and easily affixed to any flat surface by applying a small amount of silicone grease, which is supplied with the instrument, and sticking the thermometer in place. This silicone grease does not melt and so holds the instrument throughout all ranges of temperature, providing an excellent thermal coupling between the surface to be measured and the instrument.

Also with the thermometer is furnished a small magnetic clamp which will hold it securely in place when applying it on steel dies or other ferrous surfaces. The thermometer may be placed on pipes carrying heated or cooled liquid by affixing it in place by either the magnetic clamp or the silicone grease.

The thermometer has been thermo-dynamically designed to produce an essentially unilateral thermal instrument which indicates the temperature from the back of the instrument only. A highly reflective evaporated mirror on the dial insures the thermal element against external radiation. The range is 0° to 300° F. calibrated in 2° increments.

Tracerlab, Inc., 130 High St., Boston 10, Mass., has developed two new model **absorption and backscatter beta gauges** for the low-cost determination of the weight per unit area of sheet materials. The new gauges are said to incorporate several improvements making them more suitable to industrial use. These gauges are finding wide application on calenders in the rubber field.

Two new **screen specialties** for fine screening, pulverizing and filtering have been made available by the Pyramid Screen Co., 30 Church St., New York 7, N. Y. They are BF conical hole perforated plates and BY electrolytical perforated plates, both available in a wide range of perforation sizes.

Whatever your product is, if it is expected to withstand sunlight during its service life it should be tested in an Atlas Fade-Ometer.

Because the Fade-Ometer accurately reproduces natural sunlight in your laboratory, it can tell you (in just a fraction of the time required by actual outdoor exposure) whether your product will fade, whether its finish will crack or peel, or how it will react to certain conditions of temperature and humidity. Information of this type has been proved invaluable in the development of a new product or simply for controlling production line quality of an existing one.

From 21 to 126 samples can be simultaneously tested in the Fade-Ometer. Operation of the machine is completely automatic, and it may safely be left in unattended continuous operation overnight.

Extensively used to comply with government and civilian specifications.

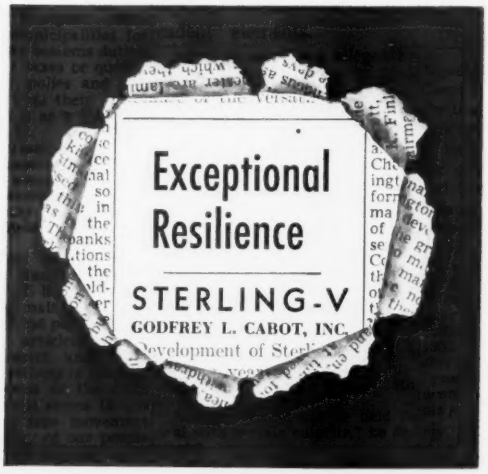
Write for your copy of the Fade-Ometer catalog

ATLAS ELECTRIC DEVICES COMPANY

361 West Superior St., Chicago 10, Ill.

Manufacturers of accelerated testing equipment for more than a quarter of a century.

WEATHER-OMETERS • LAUNDER-OMETERS • FADE-OMETERS



THE SMACO GASKET SPLICER

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Features

- SPEED
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- LONG LIFE HEATERS AND THERMOSTATS

Ask ABOUT OUR HAND RUBBER CUTTER

For Further Information . . . . Write to
SIVON MACHINE & MFG. CO.
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For Rubber Factory High Pressure Reducing Valve Service } *during* 1952

form the good habit of always specifying the

ATLAS Type "E"

High Pressure Reducing Valve

Pressures in rubber factories seldom go higher than 6000 lb. per sq. in., hence ATLAS Type "E", shown here, is usually recommended for high pressure work. This outstanding valve handles the highest working pressures *without shock*—air, water, or oil.

STELLITED

The main valve and seat ring, subject to severest abrasion and corrosion, are Stellited. Other internal parts are of hard chromium plated stainless steel. And so on. Ask for complete details.

REGULATING VALVES FOR EVERY SERVICE

For over a half century ATLAS has been making regulating valves exclusively. Want full information on any of those ATLAS products that are listed below?

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251 South St., Newark 5, N. J.
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☐ Please send complete information on the ATLAS High Pressure Reducing Valve. Also, please send information on the following ATLAS rubber factory products.

☐ Campbell Boiler Feed Regulators
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☐ Control Valves
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Write your name, firm, and address on the margin of this page, tear out with this ad., mail, and you will hear from us promptly.

Designed To Extrude RUBBER or PLASTICS

IN these days of rapidly changing developments owners of Royle extruding machines are in the advantageous position of being able to adapt their extruders to either rubber or plastics production. If you are faced with the problem of extruding rubber and plastics the versatility of ROYLE extruders is of paramount importance to you. Whether you require a light or heavy production extruder features have been incorporated to assure maximum results. The change-over is quickly and simply accomplished.

Send for your copy of Bulletin No. 448. It describes these features and how they may be applied to older type extruders.

ROYLE # 2 Extruding Machine. Non-extended cylinder, plain tubing head.

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

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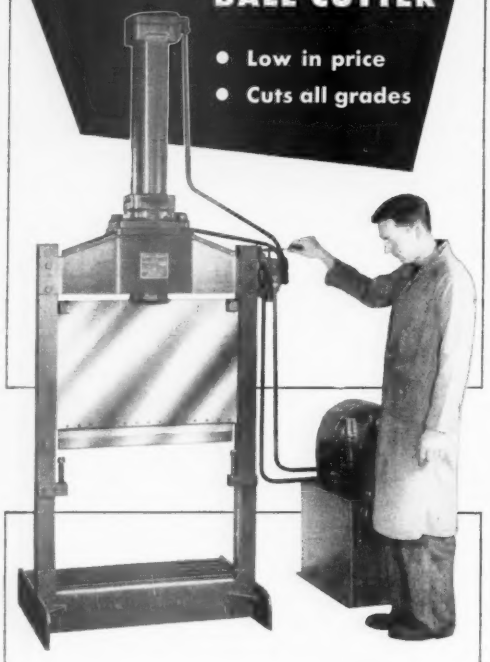
You'll cut costs, too, with--

The HOLMES
CRUDE RUBBER
BALE CUTTER

- Low in price
- Cuts all grades



Special control valve...set high up
...reduces injury hazard--makes it
one of the safest cutters on the market

Top performance...low operating cost...maximum safety--these are the three main reasons why the Holmes Crude Rubber Bale Cutter is in daily use in so many leading plants in the rubber industry.

As illustrated, it is a complete, self-contained unit with pump, tank, and 5 H.P. motor. Knife--29¼" wide. Stroke--23". Height--8' 5". Floor Space--36" x 64". And--the initial cost is low.

WRITE OR WIRE FOR SPECIFIC DETAILS--regardless of your particular requirements. With 50 years know-how specializing in machinery and molds for the rubber industry--Holmes can help you solve your problems, too, as they have for so many others. No obligation, of course.

Stanley H. HOLMES Company
Successor to Holmes Bros., Inc.
440 N. Sacramento Blvd., Chicago 12, Ill.

REVIEWS

Metal Stitching—A New Technique in Fastening. Acme Steel Co., 2840 Archer Avenue, Chicago 8, Ill. 8½ x 11 in. 12 pp.

The technique, advantages and limitations of the metal-stitching method of fastening metals to metals and metals to non-metals with high tensile strength wire stitches are described in this booklet. A series of line-drawings illustrate the types of loop and flat-clinched stitches; typical sections that can be stitched; the six standard clincher-die profiles; the four basic clincher mountings; standard and special clincher-supporting arms; head and body dimensions; limitations and specifications for both loop and flat-clinching machines, and work clearances below the work surface for flat-clinching machines. Tabular stitching-wire data gives standard wire sizes (in inches and Washburn and Moen-gage sizes); tensile strengths of standard and special wires; wire ductility; standard wire finishes; and wire-size tolerances. Other tables give shear-strength values of stitches perpendicular, parallel and diagonal to line of pull and recently-compiled maximum stitchable thicknesses for 12 metals and 11 non-metals. Eight application photographs illustrate a few of the many possible stitchable metal-to-metal and metal-to-non-metal combinations. Text and photographs describe and illustrate loop and flat-clinching machines and their interchangeable work-supporting arms. Photo-illustrated user case histories are also presented.

•

Some Factors Affecting the Use of Neoprene with Cellulosic and Other Acid Sensitive Materials. (BL-243). Rubber Chemicals Div., E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 6¼ x 9½ in. 8 pp.

This technical report calls attention to the fact that there have been numerous references in the technical literature concerning the evolution of hydrochloric acid from neoprene. Much of the information which has been published, by Du-Pont and others, has concerned proper compounding and application techniques. However, in spite of this, there have been occasional examples of improper use. In the interest of better understanding, therefore, this report discusses some of the fundamental aspects of acid evolution.

•

Production Control Systems and Procedures. (Publication X-12681). Management Controls Division, Remington Rand, Inc., 315 Fourth Avenue, New York 10, N. Y. 9¼ x 11¾ in. 56 pp.

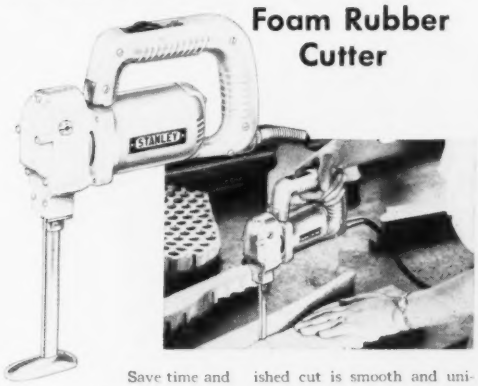
A unique method of materials control that results in a shorter production planning cycle while speeding production by eliminating the causes of varied delays on the production line is described in this book. Fully illustrated with typical forms and procedure charts, the book outlines complete procedures for engineering, production planning and progress, machine load, material and tool procurement and control. Included is a typical case history which reviews an installation that has been a successful operation for several years.

•

Sundex 41. Sun Oil Co., 1608 Walnut St., Philadelphia 3, Penna. 8½ x 11 in. 16 pp.

Sundex 41, a new processing aid for cold rubber, is described in this booklet. A special section gives detailed reports on laboratory-scale and factory-scale mixing and milling runs of cold rubber stocks containing the product. Physical data are included. The booklet also tells how Sundex 41 helps to prevent scorching during mixing, milling, and extruding; aids dispersion of compounding ingredients; reduces power consumption, and contributes to improved wear resistance and flex life of cured products.

STANLEY No. 99 Sponge or Foam Rubber Cutter



Save time and materials in cutting sponge and foam rubber with this new Stanley electric tool. Cuts at speeds up to 30 feet a minute on thicknesses up to 4". Follows any line or templet with hairline precision. Finished cut is smooth and uniform. Light weight (4 lbs.) and duplex handle make it easy for girl operators to handle. Ask your tool supplier about the No. 99, or write for literature. Stanley Electric Tools, 562 Myrtle St., New Britain, Conn.

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REVIEWS (CONT'D)

Management Planning Under Mobilization. (General Management Series No. 153). American Management Association, 330 West 42nd St., New York 18, N. Y. 6 x 9 in. 48 pp. $1 (members); $1.25 (non-members).

The papers presented in this booklet were originally given at the General Management Conference of the American Management Association in New York City on June 7 and 8, 1951. Under the general heading of "Economic and Labor Relations Factors in Management Planning," three papers were presented. These were: (1) The Setting of the Problem, (2) Critical Economic Factors and Their Effect on Current Management Planning, and (3) Collective Bargaining in a Defense Economy. Other papers included in the booklet are: "The Challenge of Planning the Middle Term", "Perspective on the Current Management Job", and "The Management Improvement Program of the United States Department of Defense."

•

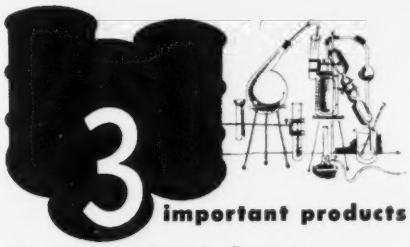
Flintkote Industrial Products Digest. Industrial Products Division, Flintkote Co., 30 Rockefeller Plaza, New York 20, N. Y. 5½ x 8 in. 24 pp.

This pocket-size, illustrated booklet briefly describes many of the standard and specialized items comprising the company's products for industry. It is intended to serve as a guide to specific as well as custom formulated asphalt emulsion and cutbacks, asphalt, rubber and resin adhesives, coatings and sealers. Among the items described are protective coatings, flooring binders and cements, underlayments for decorative floors, sound deadener and insulating compounds, sealers for joints in concrete pavement, packaging specialties, and sizes and laminants for fibreboard.

•

Harflex Plasticizers. Hardesty Chemical Co., 41 East 42nd St., New York 17, N. Y. 8½ x 11 in. 10 pp.

This brochure presents the specifications, physical properties and recommended uses for the more important plasticizers now manufactured by the company. An outstanding feature of the publication is a quick reference table which compares the physical properties of the more important plasticizers. Factors listed in the table include appearance, color, odor, boiling point, flash point, freezing point, viscosity, molecular weight, specific gravity, weight per gallon, saponification number, etc.



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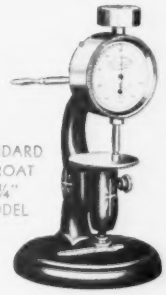

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VISCOSITY, SSU @ 100°F	240

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REVIEWS (CONT'D)

Battelle. Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio. 8½ x 11 in. 36 pp.

This handsome booklet describes the services which are offered to industry by the Institute, the facilities available for the performance of these services, and the personnel responsible for the maintenance of the program. Many of the laboratories and research equipment used at Battelle are described and illustrated. The full scope of Battelle research is outlined and the contributions which the Institute has made to industrial progress are cited. Methods of research, sponsors and fields of research are all covered. The booklet is illustrated with photographs, drawings and charts.

•

Precision Thread and Form Grinders. (Catalog No. TFG 13579-51). Sheffield Corp., Dayton 1, Ohio. 8½ x 11 in. 12 pp.

The Sheffield line of precision thread and form grinders is covered in this illustrated catalog. In condensed form, it presents a wealth of useful information about this line of machine tools. Specifications and features of each of the units are presented. Five different models of the Precision Thread and Form Grinder are outlined as to specifications and other pertinent data in a series of catalog insert sheets.

•

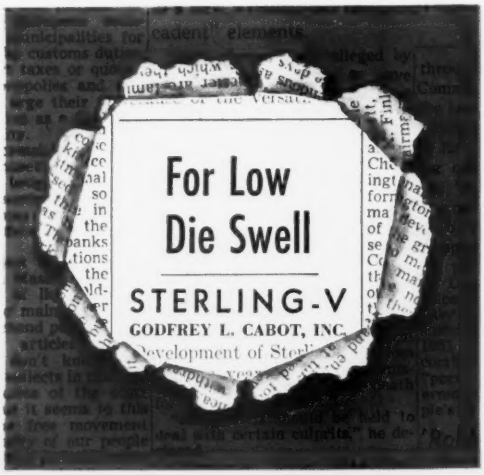
Profitable Production with Payloaders. (Catalog No. 205). Frank G. Hough Co., 872 Seventh St., Libertyville, Ill. 8½ x 11 in. 12 pp.

This catalog shows bulk-material-handling applications of "Payloader" tractor shovels in many different kinds of plants. It also lists users in specific industries. Valuable job studies and performance data from certain applications are included and specification data on the many models and sizes of the "Payloader" travel shovels have also been added.

•

Emery Esters for Synthetic Lubricants. Development and Service Dept., Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio. 9 x 11½ in. 15 pp.

Three new Emery diesters now available to manufacturers of synthetic lubricants and specialty greases are described in this technical bulletin. Two of the new products are esters of azelaic acid, while the third is the dibutyl ester of Emery 955 Dimer Acid (di-linoleic acid). All three diesters are characterized by low pour points, high flash and fire points.



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OBJECTS: To promote corporate and concerted effort in the industry by bringing together all those engaged or interested in the various branches of science and technology on which the Industry is based and co-ordinating their respective contributions.

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To maintain a scheme of Diplomas for the recognition of efficiency in knowledge of all branches of technology essential to the successful maintenance and development of rubber manufacture.

To arrange for the holding of meetings, the reading of papers and the giving of lectures with subsequent discussions and publication.

To foster the systematic study of scientific and technical problems involved in the various phases of the manufacture of natural and synthetic rubbers and rubber-like materials and their conversion into finished products.

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LONDON, S.W. 1, ENGLAND

REVIEWS (CONT'D)

The Structure of Cyclized Rubber. By G. J. Van Veersen. (Communication No. 122). Rubber-Stichting, Delft, Holland. 6¼ x 9½ in. 20 pp.

The history of cyclized rubber, including a series of structural formulae previously proposed for this polymer, is briefly reviewed in this technical report. A new formula for cyclized rubber is suggested by applying electronic interpretations of reactions between electrophilic agents and tertiary alkyl olefins and tertiary halides, respectively, to the corresponding reactions with rubber and rubber halides. It is shown that hydrochlorination can be used for the determination of the unsaturation of cyclized rubber. By varying the conditions of hydrochlorination two types of double bonds can be detected in cyclized rubber, a fact which is in agreement with the structure suggested. By using the suggested method for the determination of the unsaturation, the rate of cyclization at different temperatures and the influence of solvents on the rate of reaction have been determined. The report is illustrated with charts, tables and diagrams.

•

Man-Made Fibers. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 9 x 12 in. 32 pp.

This booklet is designed to trace the rise of the synthetic fiber industry and to report on the development of DuPont's five fibers—rayon, acetate, nylon, Orlon and Dacron. The booklet also attempts to show the sharp impact which these chemical fibers have had on America's living patterns. To this end, in word and text, it documents one of the most dramatic and significant achievements of modern industrial technology. In reviewing this booklet, mention must be made of the many beautiful photographs and the consistently interesting and informative text matter.

•

Vane Type Electric Contact Controllers. (Catalog No. 80000). Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Penna. 8½ x 11 in. 16 pp.

This catalog illustrates and describes vane type electric contact control units used with Brown "Electr-O-Vane" thermometers and pressure gauges, and with the "Electronik" potentiometer, as well as those employed in the new "Pyr-O-Vane" and "Protect-O-Vane" millivoltmeters, to give snap-action on-off, two position or three position control. Schematic wiring diagrams, charts and photographs are provided.

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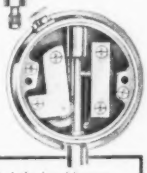

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- Natural and Synthetic Latex Compounds
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Continuing research and development in our laboratory and rigid production control has made us the leader in this field.

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Roller Mills, Kneaders and Mixers. (Catalog No. 118-A). Charles Ross & Son Co., 148 Classon Avenue, Brooklyn 5, N. Y. 8½ x 11 in. 16 pp.

This catalog offers complete details and specifications on the company's latest model High Speed Three Roller Mills in sizes 4½ by 10 inches, 6 by 14 inches, 9 by 24 inches, 12 by 30 inches, 14 by 32 inches, and 16 by 40 inches. Double arm kneading machines with mixing or dispersion type blades are fully described and illustrated in one pint to 150-gallon sizes. Mixers of all types, both horizontal and vertical, are shown for the mixing of heavy paste materials, semi-paste, liquids and dry products. Sizes vary from laboratory or pilot scale size to large production size units. Complete details are given on two-speed or variable-speed motors, jacketed tanks for steam heating or water cooling, and various types of motor drives. In addition, special types of equipment are shown which are designed and offered for particular processing requirements.

•

Barrett Standard Industrial Chemicals. Barrett Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. 8¼ x 10⅞ in. 16 pp.

A listing of the standard industrial chemicals produced by the Barrett Division is offered in this catalog. Included are tar acids, tar acid oils, phthalic anhydride, plasticizers, phenolic resins, "Cumar" resin, Resin S, rubber compounding materials, naphthalene, coal-tar bases, Niacin, light oil distillates, flotation agents, pickling inhibitors, tar distillates, nitrogen products and specialties. All are described and applications discussed. The catalog is illustrated with photographs, charts and tables.

•

Alamask Odorants for the Rubber Industry. Aromatics Section, Organic Chemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 3½ x 6¼ in.

This folder describes the full line of Alamask odorants manufactured for the rubber industry by the company. It also suggests methods of using the odorants so as to secure the most effective results. The use of the odorants in latex products, in dry rubber products, and in elasto-plastics are considered. Their use in controlling common plant odors is also outlined. The type of Alamask odorant to use in various products is outlined in handy chart form.

Tough?
SEE PAGE 412

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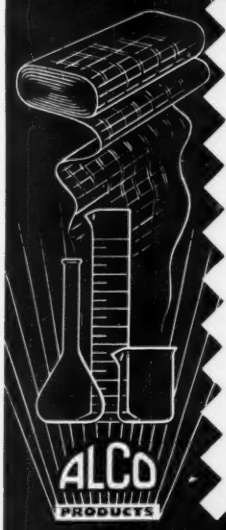

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VULCARITES are supplied as individual dispersions of zinc oxide, sulfur, antioxidants and accelerators. Composite dispersions of these chemicals are also available.

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, JAN. 9, 1952

Natural Rubber

Total ocean shipments from Malaya in December were 90,576 long tons against 94,988 long tons in November. Shipments to the United States in December totaled 37,983 long tons, the largest since June, 1951. In November, 1951, a total of 28,855 long tons were shipped to the United States.

While official figures on the stockpile of natural rubber in Great Britain are not made public, it is estimated that the total may be near 80,000 tons. The trade reports that a feeling persists that a good portion if not all of this stockpile will be sold to the United States. It is doubtful that this rubber stockpile will be shipped to the United States, but rather used for military purposes in Europe.

In view of the relatively high prices abroad, very little rubber is being offered to the United States at this time. Other than some moderate quantities which have been taken from areas outside of Malaya and Indonesia, purchases for the stockpile since the third week in December have been extremely small.

Trade sources report that it is likely that the United States will again attempt to rotate its stockpile within the next two or three months. If this proves to be a fact, then the demand for lower grades of rubber from abroad will be somewhat restricted, in that the government will attempt to replace low grades of rubber in stock with the highest grades obtainable. This situation could create a distorted picture in the world's natural rubber market for some little time.

Quotations for the markets in London and Singapore follow:

London Market

(Standard Smoked Sheets)

February	47.81 - 48.12
March	47.84 - 47.88

Singapore Market

(Standard Smoked Sheets)

February	46.14 - 46.27

Domestic Natural Rubber Prices

Grade	*Price (per lb.)*
Rubber Smoked Sheets—No. 1	52c
No. 2	51¾
No. 3	50½
No. 4	48½
No. 5	44
Thin Latex—No. 1X	60
No. 1	59
No. 2	56
No. 3	53
Thick Latex—No. 1X	60
No. 1	58
No. 2	56
No. 3	53
Thin Brown—No. 1X	47
No. 2X	44½
No. 3X	40
No. 1	42
No. 2	41
No. 3	40
No. 4	38
Blanket (Amber)—No. 2	42
No. 3	41
No. 4	40
Smoked Blanket—No. 1	42
No. 2	40
Flat Bark	34
Beni Bolivian Para	45
Upriver Fine Para	43
Liquid Latex	64

Note: These are General Services Administration Prices (plus service charges) for delivery ex G.S.A. shipping points.

Scrap Rubber

Trade predictions for 1952 state that with tire factories scheduled to produce second-line tires, increased demand for tire scrap for tire reclaim will result. What 1952 may hold forth otherwise will depend a great deal on the availability of GR-S and the continuous supply of natural rubber. OPS-established prices for scrap rubber follow:

(Prices Delivered Akron)

Mixed tires	ton	$26.00
Mixed headless tires	ton	34.00
Light colored carcass	ton	130.00
Black carcass	ton	50.00
No. 1 peelings	ton	65.00
No. 2 peelings	ton	42.00
No. 3 peelings	ton	38.00
Buffings	ton	30.00
Truck and Bus S.A.G.	ton	28.00
Passenger S.A.G.	ton	28.00
Mixed S.A.G.	ton	26.00
Light colored tubes	lb.	.16
Natural rubber red tubes	lb.	.16
Natural rubber black tubes	lb.	.11½
Mixed natural rubber tubes	lb.	.10
Butyl rubber tubes	lb.	.057
GR-S rubber tubes	lb.	.02
Mixed synthetic tubes	lb.	.03

Reclaimed Rubber

Consumption of reclaimed rubber in the first ten months of 1951 has been estimated at 299,807 long tons by the United States Department of Commerce, as compared with the 243,200 long tons consumed in the first ten months of the previous year. As of October 31, 1951, the department listed 45,200 long tons as stocks on hand. OPS-established prices for reclaimed rubber follow:

(Prices for All Areas Except Calif.)

Premium Grade Whole Tire	.10½
First Line Whole Tire	.10
Second Line Whole Tire	.09½
Third Line Whole Tire	.09¼
Fourth Line Whole Tire	.08¾
Black Carcass	.14½
No. 1 Light Colored Carcass	.20¾
No. 1 Select Peel	.11¾
No. 1 Peel	.10½
Butyl Tube Reclaim	.14¾
S.P. Natural Rubber Black Tube	.21
Natural Rubber Black Tube	.20
Natural Rubber Red Tube	.24¼
Natural Rubber Gray Tube	.24¾

Cotton Tire Fabrics

A quickening of activities in the cotton tire fabric market evidenced during the past few months has been maintained during the past period. Prices have held steady after the recent upward adjustment to more accurately reflect current conditions. Current prices follow:

Standard, Peeler, 12/4-2	lb.	.90
Extra Staple, Peeler, 12/4-2	lb.	.96

Chafers

14.4 oz. (per square yard)	lb.	.86
9.25 oz. (per sq. yard)	lb.	.81
11.65 oz. (per sq. yard)	lb.	.79
8.9 oz. (per sq. yard)	lb.	.84

Cotton

The price of middling uplands on the New York Cotton Exchange has moved in a range of 2.05c since our last report (December 6), high for the period being 44.40c reached on December 7 and 8, and low being 42.35c reached on December 18. The average price of middling uplands for the month of December was 43.52c based on 24 trading days. This compares with an average of 42.70c in November.

A drive to get higher government price supports for cotton will be very much in evidence in Washington during the next several weeks, trade sources report. The House Agricultural Committee may suggest to Agriculture Secretary Charles F. Brannan that he use his authority under the 1949 Agricultural Act to set up a public hearing to consider a support level for cotton higher than 90% of parity. This may be accomplished in view of the 16,000,000 bale crop goal set by the government for 1952 and the failure of growers to meet a 16,000,000 bale goal in 1951.

World production of extra-long-staple cotton in the 1951-52 season has been estimated at the rather low total of 880,000 bales by the International Cotton Advisory Committee. This is a reduction of 237,000 bales, or 21% below production of last season, and some 70,000 bales less than the post-war average.

With the 1951-52 season well advanced, world cotton consumption is running somewhat under last season's annual rate of 33,000,000 bales. The textile recession is most severe in the United States where first quarter consumption was at the rate of 9,500,000 bales, or 1,000,000 less than last season.

Quotations for middling uplands on the Exchange follow:

	Dec. 7	January 9	
	Close	High	Low	Close
Mar.	43.89	42.82	42.81	42.57
May	43.10	42.65	42.43	42.44
July	42.50	42.22	42.00	42.08

Synthetic Rubber

(Dry Types—Per Pound)

Butaprene NF	.465	- .475
Butaprene NL	.475	- .485
Butaprene NAA	.515	- .525
Butaprene NXM	.550	- .560
Chemigum 36N4NS	.460	- .470
Chemigum 50N4NS	.460	- .470
Chemigum N3	.450	- .520
G.E. Silicone Rubber (compounded)	3.20	- 4.40
G.E. Silicone Gum (not compounded)	——	- 5.00
GR-I	——	-.2075
GR-S	——	- .260
Hycar OR-25	.450	- .460
Hycar OR-15	.520	- .530
Hycar OS-10	.500	- .510
Neoprene Types CG and AC	——	- .500
Neoprene Type E	——	- .650
Neoprene Types FR and KNR	——	- .800
Neoprene Type GN	——	- .380
Neoprene Type GS-A	——	- .380
Neoprene Type RT	——	- .400
Neoprene Type S	——	- .380
Neoprene Type W	——	- .400
Paracril B	.500	- .510
Paracril BJ	.500	- .510
Paracril C	.580	- .590
Silastic (compounded)	2.35	- 4.40
Thiokol Type A	——	- .470
Thiokol Type FA	——	- .640
Thiokol PR-1	——	- .950
Thiokol Type ST	——	-1.000

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STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS									RE-EXPORTS		TOTAL NET IMPORTS
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule					
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Total Gross Imports Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	132,072,496	14.54	19,852	6,659,899	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,694	745,873	12.36	600,479	7,902	3,385,433	592,577
1938	397,640	125,373,864	14.08	11,944	4,168,127	15.58	2,508	628,886	11.19	412,092	5,652	1,799,124	406,440
1939	469,946	167,586,780	15.92	27,437*	10,467,532	17.03	2,233	463,345	9.27	499,616	13,125	5,832,618	486,491
1940	781,202	303,308,823	17.33	33,789	14,593,466	19.28	3,633*	758,007	9.31	818,624	7,060	3,197,136	811,564
1941	989,498	401,976,317	18.14	34,797*	15,965,627	20.48	4,881	1,145,767	10.48	1,029,176	5,376	2,757,872	1,023,800
1942	266,276	112,537,426	18.87	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,445	10,856	5,913,386	271,589
1943	80,358	31,369,198	27.81	1,890	1,312,202	31.00	7,678*	3,636,789	21.14	89,926	22,583	16,446,707	37,343
1944	103,847	73,908,549	31.77	3,091	2,092,211	30.99	6,701*	3,351,233	22.33	113,639	9,739	8,712,695	103,900
1945	134,408	95,814,102	31.82	4,733	3,115,853	30.22	10,040	5,963,797	26.52	149,221	9,509	7,201,746	139,712
1946	366,415	222,552,939	27.12	8,421	5,843,085	29.14	5,344	2,859,246	23.89	380,180	7,711	5,331,954	372,469
1947	691,087	306,951,814	19.83	17,542	9,787,722	30.98	2,884	1,492,825	23.11	711,513	4,121	2,354,494	707,392
1948	702,293	290,849,177	18.49	32,745	9,820,080	24.93	302	71,330	10.53	735,340	6,672	3,259,424	728,668
1949	630,818	225,141,459	15.95	29,974	14,970,478	22.30	....	.....	....	660,792	6,253	2,746,109	654,539
1950	751,966	418,794,962	24.85	51,627	39,717,410	34.34	740	254,331	14.54	803,593	8,640	6,832,821	794,953
1950:													
July	53,245	27,256,854	20.11	4,225	2,710,430	28.64	70	26,836	17.11	57,540	683	381,650	56,857
Aug.	67,415	36,092,742	23.90	5,253	3,721,184	31.62	35	9,671	12.34	72,703	1,005	914,279	71,698
Sept.	55,981	36,724,072	29.23	5,117	4,369,707	38.12	55	15,148	12.34	61,153	879	798,935	60,274
Oct.	73,205	53,151,003	32.41	5,161	5,485,816	47.46	10	7,496	33.18	78,376	564	500,623	77,812
Nov.	68,462	62,121,636	40.51	4,456	6,227,022	56.71	29	21,618	33.46	72,947	604	724,050	72,343
Dec.	65,282	66,092,508	45.11	3,954	5,191,321	58.62	25	24,864	44.40	69,236	1,400	1,757,047	67,836
1951:													
Jan.	84,864	90,707,863	47.72	7,502	10,283,208	61.18	88	84,977	43.01	93,366	819	1,150,246	92,547
Feb.	49,217	55,013,580	49.90	5,347	8,314,086	64.91	123	119,086	43.27	54,687	552	790,245	54,135
Mar.	55,574	63,104,361	56.92	7,379	11,140,554	67.40	100	100,048	44.61	62,553	322	449,703	62,231
Apr.	48,931	55,238,582	50.31	5,850	9,604,002	73.29	182	183,311	44.93	54,963	3	3,942	54,960
May	37,717	44,187,969	52.27	4,534	7,564,613	74.67	99	80,285	36.16	42,370	7	11,132	42,363
June	51,811	61,809,219	53.26	4,692	7,475,970	71.13	120	84,110	30.14	56,623	224	423,689	56,399
July	67,511	78,807,699	52.11	5,619	8,522,995	67.71	134	99,482	28.82	73,284	....	.....	73,284
Aug.	66,217	70,536,735	47.55	4,529	5,805,789	57.23	148	93,807	28.31	70,894	159	290,479	70,735
Sept.	59,309	57,619,906	43.44	1,800	1,848,512	45.59	121	78,427	29.00	61,230	89	45,061	61,141

Source: U. S. Department of Commerce. * Adjusted to agree with total gross imports.

Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule. (3) In the years 1940 through 1943, crepe sole rubber imports were reported under a separate classification. Such imports, which are included under natural rubber, dry above, were: 856,294 pounds, valued at $191,097 in 1940; 379,607 pounds, valued at $85,924 in 1941; 662,503 pounds, valued at $159,530 in 1942; and 21,653 pounds, valued at $5,215 in 1943.

Natural Rubber (Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1936	488,145	575,000	12,581	223,000
1937	600,479	543,600	7,902	262,204
1938	417,984	437,033	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,464
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,534	144,113	9,665	93,650
1945	148,672	105,429	6,743	118,713
1946	400,857	277,597	4,338	237,367
1947	688,351	362,661	4,101	129,038
1948	735,217	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	803,143	720,268	8,644	91,434
1950:				
July	61,660	61,402	683	93,653
Aug.	72,973	64,297	1,005	87,146
Sept.	61,148	61,281	879	87,409
Oct.	78,376	69,178	564	83,215
Nov.	73,393	51,340	604	81,658
Dec.	67,895	44,999	1,400	91,434
1951:				
Jan.	92,454	44,586	819	93,079
Feb.	54,564	37,572	552	87,242
Mar.	62,904	35,335	332	76,312
Apr.	54,781	39,508	185	71,679
May	42,571	42,445	151	68,498
June	56,504	39,998	224	68,369
July	73,180	35,478	....	67,816
Aug.	77,338	36,506	158	67,491
Sept.	61,409	36,887	27	56,941
Oct.	64,750	37,478	271	63,910

Source: U. S. Department of Commerce.

U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

	Balata		Jelutong		Gutta-Percha & Other Guttas	
Year	Tons	Value	Tons	Value	Tons	Value
1936	535	199,368	6,163	1,296,364	1,568	555,643
1937	354	151,344	7,109	2,017,786	1,122	440,894
1938	509	181,140	9,132	2,944,504	444	204,582
1939	694	265,553	6,640	1,603,418	1,740	539,255
1940	648	300,500	7,451	2,449,137	2,340	1,004,885
1941	924	489,514	8,821	2,954,001	1,783	607,025
1942	1,544	1,107,059	1,200	530,296	804	525,763
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1950:						
May	78	50,093	114	103,796	69	86,151
June	143	74,936	120	104,123	49	112,902
July	109	53,480	118	101,258	64	87,284
Aug.	171	102,985	234	200,912	46	41,790
Sept.	119	102,475	175	146,493	37	59,004
Oct.	372	311,959	174	132,632	64	146,707
Nov.	735	588,135	214	183,907	51	102,599
Dec.	124	126,709	82	91,411	28	16,361
1951:						
Jan.	242	200,534	184	227,244	108	118,988
Feb.	86	76,034	128	214,303	12	11,014
Mar.	30	22,838	192	222,934	33	65,143
Apr.	364	241,725	86	180,518	43	39,402
May	386	260,459	130	194,904	26	22,515
June	227	153,222	151	250,828	72	63,998
July	115	94,073	193	308,222	23	32,106
Aug.	121	136,723	142	224,194	8	7,060
Sept.	307	227,392	62	105,395	12	14,660

Source: U. S. Department of Commerce.

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Synthetic Rubber—Totals

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1941	8,383	.....	6,259	572	1,702
1942	22,454	.....	17,651	1,419	4,612
1943	231,722	.....	170,891	18,148	41,568
1944	762,630	11,943	566,670	104,266	142,927
1945	820,373	10,407	693,580	83,778	203,454
1946	740,026	7,709	761,699[a]	72,920	114,963
1947	598,702	1,094	559,566	11,385	62,366
1948	488,344	15,671	442,072	4,874	115,111
1949	393,690	17,242	390,855	6,483	98,042
1950	476,184	25,722	538,289	7,652	52,758
1951:					
Mar.	65,286	1,152	65,387	526	60,614
Apr.	60,414	1,148	58,787	554	65,793
May	70,541	518	65,027	596	70,276
June	74,188	445	64,718	534	78,154
July	76,250	515	61,419	966	89,527
Aug.	74,053	620	67,260	773	96,382
Sept.	70,870	523	68,460	995	99,899
Oct.	79,285	692	69,189	657	111,215

Source: U. S. Department of Commerce.

Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures shown include the output of both government and privately-owned plants. (3) Figures for 1941 are estimated. [a] Includes year-end adjustment of 5,384 tons to cover non-reporting companies.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)	GR-I (Butyl)	Buna N Types	Total
1943	182,259	35,603	1,073	14,487	231,722
1944	679,949	56,660	20,252	16,812	773,673
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795
1948	403,492	34,848	56,662	7,012	504,014
1949	310,599	35,215	54,046	11,072	410,932
1950	378,857	50,067	60,915	12,037	501,906

Consumption

1943	121,977	26,205	304	12,405	170,891
1944	495,532	46,243	10,763	14,112	566,670
1945	600,145	42,394	43,012	8,029	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,436	559,566
1948	345,313	33,118	58,870	5,771	430,618
1949	299,420	31,753	50,855	8,827	397,139
1950	416,230	43,781	66,348	11,930	538,289

Exports

1943	14,857	2,540	40	631	18,148
1944	98,360	4,799	530	557	104,266
1945	76,555	5,837	980	406	83,778
1946	68,763	2,942	495	797	72,997
1947	7,953	2,617	62	753	11,385
1948	3,475	1,275	321	885	4,874
1949	3,401	2,330	178	1,574	6,483
1950	5,008	4,826	31	1,895	7,652

Stocks at End of Period

1943	30,975	6,415	1,033	3,145	41,568
1944	116,340	13,719	9,892	3,166	142,927
1945	170,371	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,753	115,186
1947	40,606	5,237	13,184	3,339	62,366
1948	99,282	5,072	10,995	2,762	115,111
1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758

Source: U. S. Department of Commerce.

Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures for GR-M and Buna N Types include production of privately-owned plants.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1944	1945	1946	1947	1948	1949	1950	1951
Jan.	47,840	52,008	51,746	57,057	61,308	63,125	66,908	80,554
Feb.	47,754	48,886	47,654	50,551	56,487	57,980	63,366	72,717
Mar.	53,263	55,364	56,763	59,947	68,171	73,282	78,739	86,496
Apr.	59,005	59,024	62,111	64,140	72,183	73,318	80,348	87,430
May	54,230	60,748	66,860	70,865	77,186	81,665	89,033	100,188
June	54,266	60,580	63,247	71,329	78,044	83,374	90,010	96,093
July	53,134	66,170	60,076	73,441	81,428	82,129	91,707	100,476
Aug.	55,618	70,058	66,729	72,089	80,351	84,707	94,537	101,206
Sept.	56,318	64,529	62,268	71,384	76,159	80,852	86,766	91,803
Oct.	53,134	55,208	66,637	73,277	75,164	79,337	89,126	99,945
Nov.	54,967	53,543	61,345	64,158	72,360	76,346	82,718	.....
Dec.	52,250	49,745	61,101	67,506	72,162	75,628	80,994	.....
Total	635,482	696,333	735,417	795,015	871,270	913,713	994,412	....

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption: Tons	Consumption: % to Crude [a]	Exports	Stocks On Hand at End of Period
1936	150,571	141,486	24.6	7,085	19,000
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007 [b]	254,820	64.6	30,405	42,532
1943	304,058 [c]	291,082	59.6	15,678	46,201
1944	260,631 [d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,393	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,705
1951:					
Jan.	33,044	32,455	31.0	1,336	35,543
Feb.	30,502	28,792	31.7	1,629	36,885
Mar.	35,294	32,678	32.4	1,475	38,334
Apr.	34,311	32,428	33.0	1,398	39,064
May	35,078	34,148	31.8	1,512	39,098
June	33,529	30,999	29.5	1,416	40,268
July	29,999	25,500	26.3	1,017	44,347
Aug.	29,175	28,598	27.5	991	43,900
Sept.	26,927	26,226	24.9	970	43,095
Oct.	29,624	28,071	26.3	1,305	43,299

Source: U. S. Department of Commerce.

Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. [a] Includes natural and synthetic rubber. [b] Includes 8,915 tons of imports. [c] Includes 67 tons of imports. [d] Includes 21 tons of imports.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1931	1,973,090	416,648	2,389,738	1941	3,744,500	875,381	4,619,681
1932	1,135,491	235,187	1,370,678	1942	220,814	133,043	353,857
1933	1,573,512	346,345	1,920,857	1943	0	4,501	4,501
1934	2,177,919	573,192	2,753,111	1944	0	124,819	124,819
1935	3,252,244	694,690	3,946,934	1945	83,792	313,643	397,435
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,459
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1950:							
Jan.	487,824	93,323	581,147	July	595,067	111,028	706,095
Feb.	585,361	89,971	675,332	Aug.	682,782	134,853	817,635
Mar.	469,618	110,843	580,461	Sept.	616,827	105,562	722,389
Apr.	455,393	103,850	559,043	Oct.	651,169	108,815	723,984
May	575,519	120,963	696,482	Nov.	504,448	98,538	602,986
June	720,688	135,332	856,020	Dec.	521,371	118,890	640,261
1951:							
Jan.	478,389	127,583	606,172	July	381,407	110,244	481,651
Feb.	505,865	111,935	617,800	Aug.	426,932	121,993	548,925
Mar.	617,399	136,794	754,193	Sept.	365,906	109,353	475,259
Apr.	503,038	135,415	638,453	Oct.	414,433	110,840	525,273
May	511,938	140,047	651,985	Nov.	356,788	93,179	449,967
June	482,029	134,818	616,847	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.

Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1946	1947	1948	1949	1950
Passenger Car	15,038,469	21,346,004	23,842,796	27,715,344	35,096,404
Truck & Bus	5,939,244	7,737,353	6,920,231	4,238,174	6,625,129
Agricultural	1,735,992	2,633,699	3,140,882	2,695,430	2,853,483
Earth Mover	5,520	10,610	13,330	9,895	15,602
Total	22,739,225	31,727,666	33,917,239	34,658,843	44,590,618

	1951					
	June	July	Aug.	Sept.	Oct.	Nov.
Passenger Car	2,131,958	2,158,601	2,173,477	2,261,654	2,532,605	2,014,709
Truck & Bus	548,424	571,161	524,071	489,569	609,375	501,016
Agricultural	232,354	238,983	231,629	228,550	272,152	181,560
Earth Mover	1,418	2,470	2,901	2,309	1,529	2,227
Total	2,914,154	2,971,215	2,932,078	2,982,082	3,415,661	2,699,512

Source: The Tire & Rim Association, Inc.

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THE HOLLISTON MILLS, INC.
NORWOOD, MASS.
NEW YORK PHILADELPHIA CHICAGO

Automotive Pneumatic Casings

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1938 (total) ..	11,516	30,567	1,049	43,132	40,907	8,451
Passenger Car.	10,086	27,104	580	37,770	35,789	6,937
Truck and Bus	1,430	3,463	469	5,362	5,118	1,514
1939 (total)	18,208	38,022	1,279	57,509	57,613	8,665
Passenger Car.	15,742	33,471	607	49,820	49,933	7,108
Truck and Bus	2,466	4,551	672	7,689	7,680	1,557
1940 (total)	22,252	35,346	1,176	58,774	59,186	9,127
Passenger Car.	19,560	30,903	411	50,874	50,965	7,270
Truck and Bus	2,692	4,443	765	7,900	8,221	1,857
1941 (total)	24,780	39,895	1,489	66,164	61,540	4,436
Passenger Car.	19,855	34,119	586	54,560	50,392	3,165
Truck and Bus	4,925	5,776	903	11,604	11,148	1,271
1942 (total)	6,680	8,872	207	15,759	15,351	6,247
Passenger Car.	910	2,734	38	3,682	2,790	4,432
Truck and Bus	5,770	6,138	169	12,077	12,561	1,815
1943 (total)	6,128	18,547	225	24,900	20,423	1,883
Passenger Car.	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	6,654	26,439	263	33,356	33,446	2,013
Passenger Car.	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	5,984	36,479	504	42,967	44,524	3,077
Passenger Car.	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	15,310	65,490	1,512	82,312	82,298	2,448
Passenger Car.	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	25,056	62,871	3,256	91,183	95,550	6,949
Passenger Car.	19,644	52,437	1,608	74,109	77,795	5,444
Truck and Bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	26,845	49,148	1,787	77,781	81,314	10,698
Passenger Car.	21,589	41,295	656	63,540	66,718	8,273
Truck and Bus	5,256	7,853	1,132	14,241	14,596	2,425
1949 (total)	31,584	43,466	1,467	76,517	76,369	10,638
Passenger Car.	28,129	36,440	509	65,077	65,140	8,904
Truck and Bus	3,456	7,026	958	11,440	11,228	1,734
1950 (total)	41,349	56,808	1,430	99,587	92,754	3,794
Passenger Car.	36,678	47,103	642	84,423	78,598	3,050
Truck and Bus	4,671	9,705	788	15,164	14,156	743
1951:						
Aug. (total)	2,811	4,230	120	7,162	7,549	4,033
Passenger Car	2,356	3,225	53	5,634	6,021	2,967
Truck and Bus	455	1,005	67	1,527	1,528	1,065
Sept. (total)	2,519	3,967	171	6,657	7,429	4,767
Passenger Car.	2,105	3,021	80	5,205	5,886	3,618
Truck and Bus	414	946	92	1,452	1,543	1,149
Oct. (total)	2,553	4,313	181	7,050	7,746	5,514
Passenger Car.	2,102	3,242	78	5,423	6,077	4,315
Truck and Bus	451	1,073	103	1,627	1,669	1,198

Source: The Rubber Manufacturers Association, Inc.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton: Tire Cord Not Woven	Cotton: Cord Fabric Woven	Cotton: Chafer and All Other Tire Fabrics	Cotton: Total	Rayon and Nylon[b]: Tire Cord Not Woven	Rayon and Nylon[b]: Tire Cord And Other Tire Fabrics	Rayon and Nylon[b]: Total
1948:							
Jan.-Mar.	18,546	50,251	19,391	88,188	*a*	60,569	60,569
Apr.-June	15,585	45,385	18,213	79,183	*a*	59,759	59,759
July-Sept.	24,743	45,927	7,000	75,670	*a*	63,642	63,642
Oct.-Dec.	13,321	34,424	15,879	63,624	*a*	65,258	65,258
Total	72,195	175,987	53,483	306,665	.....	249,228	249,228
1949:							
Jan.-Mar.	*d*	33,213	25,395	56,608	*a*	68,296	68,926
Apr.-June	5,309	29,114	13,617	48,040	*a*	68,269	68,269
July-Sept.	1,343	16,620	11,141	29,104	15,640	55,969	71,609
Oct.-Dec.	180	17,650	11,886	29,716	12,967	58,890	72,857
Total	6,832	96,597	62,039	163,468	28,607	251,424	281,661
1950:							
Jan.-Mar.	3,939	19,210	12,948	36,097	12,469	60,981	73,450
Apr.-June	11,077	29,498	14,071	54,646	11,510	59,966	71,476
July-Sept.	10,529	39,792	15,101	65,152	13,161	61,614	74,775
Oct.-Dec.	13,314	37,759	14,405	65,578	12,942	63,399	76,341
Total	38,859	126,259	56,523	221,473	50,082	245,960	296,476
1951:							
Jan.-Mar.	10,929	38,223	16,737	65,889	12,715	65,275	77,990
Apr.-June	12,608	42,491	17,055	72,154	11,979	61,957	73,936
July-Sept.	16,774	44,340	17,433	78,547	12,091	67,982	80,073
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: U. S. Bureau of the Census.

Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven. (d) Included with chafer and all other tire fabrics.

Automotive Inner Tubes

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1938	11,515	28,134	644	40,293	37,848	8,166
1939	18,190	31,998	1,002	51,190	50,649	7,036
1940	22,172	29,070	972	52,214	52,237	7,017
1941	24,722	33,749	1,232	59,703	57,433	4,686
1942	6,895	7,213	159	14,267	12,685	6,206
1943	6,350	12,474	189	19,014	15,014	2,626
1944	6,460	20,569	196	27,224	27,488	2,813
1945	5,988	33,906	411	40,304	41,742	3,627
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	.....
1951:						
July	2,362	2,637	73	5,072	5,178	5,685
Aug.	2,809	2,865	87	5,761	6,139	6,272
Sept.	2,522	2,433	114	5,069	5,694	6,834
Oct.	2,549	2,911	154	5,615	6,277	7,471

Source: The Rubber Manufacturers Association, Inc.

Smoked Sheets—Spot Closing Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1910	288	141	206.60	1931	8⅝	4¼	6.17
1911	184	114	141.30	1932	4¾	2½	3.49
1912	140	108	121.60	1933	9⅞	2⅜	5.96
1913	113	59	82.04	1934	15⅞	8¾	12.92
1914	93	56	65.33	1935	13¾	10½	12.37
1915	79	58½	65.85	1936	23	13½	16.41
1916	102	55	72.50	1937	26⅜	14	19.39
1917	90	52	72.23	1938	17⅛	10¼	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¼	20.10
1920	56½	16	36.30	1941	24⅞	19½	22.40
1921	21¾	11½	16.36	1942	22½	22½	22.50
1922	28⅛	13⅛	17.50	1943	22½	22½	22.50
1923	37⅛	24¾	29.45	1944	22½	22½	22.50
1924	40⅜	17⅜	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41⅜	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅜	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	64

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1942 at 22½c. Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1944	1945	1946	1947	1948	1949	1950	1951
Jan.	20.76	22.36	25.49	32.58	36.09	33.37	31.89	45.04
Feb.	21.34	22.29	26.57	33.91	33.63	33.41	32.79	(a)
Mar.	21.65	22.43	27.52	35.89	35.04	33.44	32.65	46.06
Apr.	21.71	21.88	28.40	35.89	38.10	33.84	33.23	46.06
May	21.63	23.30	28.12	36.51	38.57	33.75	33.64	46.06
June	23.31	23.42	29.89	37.83	38.12	33.56	34.61	46.06
July	22.33	23.27	34.11	38.03	34.89	32.99	38.11	41.21
Aug.	22.11	23.10	36.31	34.83	32.23	32.06	38.93	35.93
Sept.	22.10	23.25	37.59	32.21	31.92	30.94	41.62	36.20
Oct.	22.32	23.85	36.79	32.39	32.01	30.32	40.66	38.13
Nov.	22.13	24.71	31.50	34.50	32.15	30.52	43.11	42.70
Dec.	22.28	25.21	33.03	36.74	32.90	31.08	44.37	43.32
Average for Year	21.89	23.25	31.28	35.11	34.64	32.44	37.05	42.43

Note: The Government established a ceiling price of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film [a]	Textile and Paper Coating Resins [b]	Molding and Extrusion Materials [b]	All Other [b, c]
1946	52,080	11,673	61,852	27,083
1947	66,430	17,237	73,114	27,064
1948	98,021	31,085	73,598	21,147
1949	157,344	29,470	81,842	19,792
1950	227,149	46,044	113,889	21,868
1951:				
June	14,186	3,853	13,357	2,463
July	14,081	3,852	11,496	2,579
Aug.	12,519	4,034	11,874	2,384
Sept.	11,510	3,584	10,589	1,964

Source: U. S. Tariff Commission.

Notes: (a) Includes weight of fillers, plasticizers, extenders and safety glass sheeting; (b) Resin content; (c) Includes Adhesives, but excludes data for protective coating resins. Beginning January, 1951, statistics are listed on a resin content basis.

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All Rubber Products

	1950				1951			
Mo.	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
Jan.	187	$60.52	39.4	$1.536	222	$66.78	40.4	$1.653
Feb.	188	59.90	39.2	1.528	222	63.37	38.9	1.629
Mar.	189	59.70	39.3	1.519	220	65.88	40.0	1.647
Apr.	191	61.76	40.0	1.544	219	65.96	40.0	1.649
May	194	64.52	41.2	1.566	220	68.56	41.3	1.660
June	199	65.08	41.4	1.572	220	71.27	41.9	1.701
July	200	65.59	41.2	1.592	217	70.81	41.0	1.727
Aug.	208	66.25	41.8	1.585	219	69.69	40.9	1.704
Sept.	215	66.58	41.9	1.589	218	70.36	41.0	1.716
Oct.	219	66.29	41.9	1.582	212	.....	.....	.....
Nov.	222	66.52	41.8	1.603	...	.....	.....	.....
Dec.	222	68.76	41.6	1.653	...	.....	.....	.....

Tires and Tubes

Jan.	82.6	67.70	38.4	1.763	91.3	73.69	38.4	1.919
Feb.	83.1	67.22	38.3	1.755	90.6	66.95	35.5	1.886
Mar.	83.4	65.26	37.4	1.745	88.3	71.40	37.6	1.899
Apr.	84.0	69.23	39.6	1.775	87.4	70.15	37.0	1.896
May	85.9	74.60	41.3	1.815	88.3	75.92	39.4	1.927
June	88.0	74.05	40.6	1.824	89.9	82.44	41.7	1.977
July	88.3	75.22	40.4	1.862	90.0	83.67	41.4	2.021
Aug.	89.6	76.01	40.8	1.863	91.2	82.27	41.3	1.992
Sept.	91.7	73.46	40.9	1.845	92.0	82.44	41.2	2.001
Oct.	92.0	73.12	40.2	1.819	...	.....	.....	.....
Nov.	93.4	73.70	40.1	1.838	...	.....	.....	.....
Dec.	92.1	76.21	39.9	1.910	...	.....	.....	.....

Rubber Footwear

Jan.	20.1	43.87	35.7	1.285	24.9	57.53	41.6	1.383
Feb.	18.8	43.06	34.2	1.259	25.3	55.87	40.6	1.376
Mar.	19.4	51.04	40.0	1.276	25.0	58.17	41.4	1.405
Apr.	19.3	50.36	39.5	1.275	24.8	59.82	42.1	1.421
May	19.1	50.20	39.4	1.274	25.4	61.48	42.9	1.433
June	19.3	52.67	40.3	1.292	25.7	59.98	42.3	1.418
July	19.2	52.13	39.7	1.313	24.8	54.68	39.0	1.402
Aug.	20.7	53.93	41.9	1.287	25.2	57.04	40.8	1.398
Sept.	21.8	53.95	41.5	1.300	25.3	56.02	40.1	1.397
Oct.	22.8	56.00	42.2	1.327	...	.....	.....	.....
Nov.	23.2	54.52	42.0	1.298	...	.....	.....	.....
Dec.	24.9	59.34	42.6	1.393	...	.....	.....	.....

All Other Rubber Products

Jan.	84.3	57.04	41.3	1.381	105.8	63.06	41.9	1.505
Feb.	86.3	56.43	41.1	1.373	106.3	61.95	41.3	1.500
Mar.	86.2	56.16	40.9	1.373	106.3	63.13	41.7	1.514
Apr.	87.2	57.13	41.1	1.390	106.3	63.81	41.9	1.523
May	88.8	57.92	41.7	1.389	106.0	64.09	42.5	1.508
June	92.0	59.23	42.4	1.397	104.7	64.47	42.0	1.535
July	92.8	59.08	42.2	1.400	102.2	63.29	41.1	1.540
Aug.	98.0	60.13	42.8	1.405	102.2	61.52	40.5	1.519
Sept.	101.0	61.30	42.9	1.429	101.1	62.89	41.0	1.534
Oct.	104.1	62.48	43.3	1.443	...	.....	.....	.....
Nov.	105.0	62.71	42.6	1.472	...	.....	.....	.....
Dec.	105.7	64.29	42.8	1.502	...	.....	.....	.....

Source: U. S. Department of Commerce and Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who worked during or received pay for the pay period ending nearest the 15th of the month. The employment series have been adjusted to levels indicated by Federal Security Agency data for 1947, and have been carried forward from 1947 bench-mark levels, thereby providing consistent series. Hours and earning data pertain only to production and related workers.

Production Index for the Rubber Industry

Production 1935-1939 = 100

(Based on man-hours)

	1949	1950	1951		1949	1950	1951
Jan.	193	194	244	July	175	222	243
Feb.	188	195	235	Aug.	178	236	245
Mar.	182	197	239	Sept.	174	244	246
Apr.	177	203	238	Oct.	192	250	233
May	178	213	247	Nov.	187	250	.....
June	178	221	251	Dec.	193	251	.....

Source: U. S. Department of Commerce.

Sales by the Rubber Industry

(In Millions of Dollars)

	1949	1950	1951		1949	1950	1951
Jan.	260	265	434	July	271	434	438
Feb.	251	273	434	Aug.	286	457	467
Mar.	260	293	459	Sept.	272	404	429
Apr.	257	288	439	Oct.	255	405	.....
May	248	321	432	Nov.	247	397	.....
June	266	350	433	Dec.	245	424	.....

Source: U. S. Department of Commerce.

Rubber Manufacturers' Inventories

(Based upon Book-Value)

(In Millions of Dollars)

	1949	1950	1951		1949	1950	1951
Jan.	661	524	562	July	625	501	616
Feb.	661	526	555	Aug.	563	483	640
Mar.	653	532	554	Sept.	518	502	668
Apr.	648	536	565	Oct.	517	523	668
May	650	540	583	Nov.	526	504	.....
June	644	544	610	Dec.	531	549	.....

Source: U. S. Department of Commerce.

Various Compounding Materials Consumed by the Rubber Industry

Material	1944	1945	1946	1947	1948	1949	1950
Antimony, Primary:							
Short tons	.....	.....	.....	39	41	35	.....
% of total	.....	.....	.....	.002	.003	.005	.....
Asphalt [a]							
Short tons	20,189	19,483	28,715	32,113	19,967	18,050	26,819
% of total	.006	.005	.007	.007	.004	.003	.003
Barite (Barytes):							
Short tons	10,000	10,000	20,000	17,000	18,000	14,000	.....
% of total	2.9	2.1	4.4	3.1	2.85	2.53	.....
Carbon Black:							
Short tons	369,015	402,193	470,732	471,790	435,282	383,565	515,184
% of total	94.6	95.5	95.3	94.3	95.5	93.3	92.9
Clay, Kaolin:							
Short tons	59,588	109,936	162,393	166,201	176,965	197,341	265,306
% of total	6.8	11.7	12.3	11.5	11.3	13.1	15.0
Clay, Fire & Stoneware:							
Short tons	7,160	7,800	12,951	17,970	15,480	.....	.....
% of total	0.1	0.1	0.2	0.2	0.2	.....	.....
Lime:							
Short tons	5,634	7,170	3,193	589	1,184	715	.....
% of total	0.09	0.12	0.05	0.01	0.02	.0002	.....
Litharge:							
Short tons	3,023	1,864	2,131	2,203	2,835	.....	.....
% of total	2.2	1.3	1.6	1.3	1.8	.....	.....
Lithopone:							
Short tons	726	977	1,607	3,083	4,192	3,245	.....
% of total	0.5	0.7	1.1	1.9	3.0	4.1	.....
Mica, Ground:							
Short tons	1,137	3,715	4,951	3,900	4,372	3,856	.....
% of total	2.2	7.1	8.0	6.0	7.0	7.0	.....
Sulfur:							
Short tons	63,000	64,960	72,800	72,800	70,560	59,360	.....
% of total	1.9	2.0	2.2	1.8	1.7	1.5	.....
Talc [b]							
Short tons	51,833	63,758*	65,980	71,840	66,226	53,414	.....
% of total	13.0	16.0	14.4	13.9	13.0	.32	.....
Zinc Oxide:							
Short tons	59,518	63,447	83,776	82,248	82,895	.....	.....
% of total	42.3	49.6	53.1	51.2	54.9	.....	.....

Source: U. S. Bureau of Mines.

Notes: [a] Solid and semi-solid products of less than 200 penetration. [b] Includes prophyllite and ground soapstone. * Revised.

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